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FACTORS AFFECTING SUCCESSFUL CLOUD ADOPTION IN FINNISH ORGANIZATIONS

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ABSTRACT

Kaisla Pakkanen: Factors affecting successful cloud adoption in Finnish organizations
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In literary cloud, its characteristics and models related to it have been widely discussed. Cloud services are seen to provide various benefits when compared to on-premise solutions even though there are various challenges connected to them. There is however restricted amount information available on adoption of cloud services, and interest to find out more. Therefore, intention of the research was to examine cloud adoption in Finland. It was seen as valuable to define how moving to cloud had proceeded in Finland and what were the items that had affected adoption one way or another. Therefore, the study targeted to respond the questions: What is the status of cloud adoption in Finnish large organizations and what kinds of factors affect cloud adoption and its success and how?

Literature review was done to examine the theoretical background and to study empirical research created about the subjects. Central concepts such as cloud, cloud adoption and information systems success were defined based on the findings. Literature guided to utilize diffusion of innovation theory and technology-organization-environment framework to examine the factors and their effect on cloud adoption in organizational level. Information systems success model supported with clarification of factors that affect the success of implementing new information systems such as cloud services. Literature research supported the design, testing and carrying out survey which was the primary research method of the thesis. Study was conducted to gather views on cloud service adoption from representatives of Finnish large organizations and complement material gathered from literature. Received 32 responses were analyzed and compared to literary sources to respond to the research questions and to assess the results.

The results express that the degree of large organizations that had been moved to cloud in Finland was considerably high as 94 percent of surveyed organizations had cloud services already in use. This value did not differ notably from other sources. Processes that had been moved to cloud the most were related to collaboration, human resources, customer relationship management, reporting and planning, sales and marketing. Based on results it is likely that the attention will shift in the following years to enterprise resource planning, and billing and invoicing in addition to marketing, human resources, customer relationship management, and reporting and planning. Effective factors related to cloud adoption emphasized all three contexts: technology, organization and environment. Especially relative advantage, ease of use, top management support, readiness and competence, and partner pressure were brought forward. They all are seen to be drivers of the adoption. Factors affecting cloud adoption success that were valued the most by the organizations highlighted especially items related to organization and projects. These were the state of information systems in organization, organizational competence, and culture and policies. They define the required changes, ability to prepare ahead and effort needed to adopt. In addition to these, trust was found to be considerably valuable for the success to be able to respond to the decrease of control over service. Findings of the research can be generalized to some extent. Value of the research derive from presentation of new information related to cloud adoption status in Finland, views on cloud services and importance of the factors. The findings can be utilized to compare organization's progress of cloud adoption to others, examine factors and their affect in addition to assess which factors could be worth of concentration when moving to cloud or extending the scope.

Keywords: cloud, cloud services, cloud adoption, information systems success

TIIVISTELMÄ

Kaisla Pakkanen: Onnistuneeseen pilvipalvelujen adoptointiin vaikuttavat tekijät suomalaisissa organisaatioissa
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Kirjallisuudessa pilvi, sen ominaisuudet ja siihen liittyvät mallit ovat olleet laajasti esillä. Pilvipalveluiden nähdään tarjoavan erilaisia hyötyjä verrattaessa niitä perinteisiin paikallisiin ohjelmistoihin (on-premise), vaikka niihin liitetään myös monenlaisia haasteita. Saatavilla on kuitenkin vain rajattu määrä tietoa pilvipalvelujen adoptoinnista, ja kiinnostusta tietää lisää. Siitä syystä tämän tutkimuksen tarkoituksena oli tarkastella pilvipalvelujen adoptointia Suomessa. Nähtiin tärkeänä selvittää, miten pilveen siirtyminen oli Suomessa edennyt ja mitkä asiat olivat vaikuttaneet adoptioon tavalla tai toisella. Siksi työn tavoitteena oli vastata seuraaviin kysymyksiin: Mikä on pilvipalvelujen adoptoinnin tila suomalaisissa organisaatioissa ja minkälaiset tekijät vaikuttavat adoptioon, sen onnistumiseen ja miten?

Kirjallisuuskatsaus tehtiin teoreettisen taustan ja aiheesta tehtyjen empiiristen tutkimuksien tarkastelemiseksi. Keskeiset konseptit kuten pilvi, pilvipalvelujen adoptointi ja tietojärjestelmien onnistuminen määriteltiin perustuen niistä tehtyihin löydöksiin. Kirjallisuus ohjasi hyödyntämään innovaatioiden leviämiseen liittyvää teoriaa (diffusion of innovation) ja teknologia-organisaatio-ympäristö -kehikkoa (technology-organization-environment framework) tarkastelemaan pilvipalvelujen adoptointiin liittyviä tekijöitä ja niiden vaikutuksia organisaation tasolla. Tietojärjestelmien onnistumiseen liittyvä malli tuki selvitystä tekijöistä, jotka vaikuttavat uusien tietojärjestelmien kuten pilvipalveluiden implementoinnin onnistumiseen. Kirjallisuustutkimus tuki työn ensisijaisen tutkimusmenetelmän eli kyselytutkimuksen suunnittelua, testausta ja toteutusta. Tutkimus teetettiin pilvipalveluiden adoptointiin liittyvien näkemysten keräämiseksi suomalaisten organisaatioiden edustajilta täydentämään kirjallisuudesta kerättyä materiaalia. Vastaanotetut 32 vastausta analysoitiin ja tuloksia vertailtiin kirjallisuuteen tutkimuskysymyksiin vastaamiseksi ja tulosten arvioimiseksi.

Tulokset esittävät, että suurten organisaatioiden siirtyminen pilveen on ollut huomattavan suurta, sillä 94 prosenttilla tarkastelluista organisaatioista oli pilvipalveluita jo käytössään. Arvo ei eronnut merkittävästi muista lähteistä. Prosessit, joita organisaatiot olivat eniten siirtäneet pilveen, liittyivät yhteistyöhön, henkilöstöön, asiakkuudenhallintaan, raportointiin ja suunnitteluun, myyntiin ja markkinointiin. Tulosten perusteella on todennäköistä, että huomio siirtyy lähitulevaisuudessa toiminnanohjaukseen ja laskutukseen, markkinoinnin, henkilöstön, asiakkuudenhallinnan, sekä raportoinnin ja suunnittelun prosessien lisäksi. Pilvipalveluiden adoptointiin vaikuttavat tekijät painottivat kaikkia kolmea kontekstia: teknologiaa, organisaatiota ja ympäristöä. Erityisesti suhteellinen hyöty, helppokäyttöisyys, johdon tuki, organisaation valmius ja kyvyt, sekä paine kumppanilta tulivat esille. Ne kaikki nähdään adoptoinnin edistäjinä. Organisaatiot nostivat esille heidän eniten arvostamistaan pilvipalvelujen adoptoinnin onnistumiseen liittyvistä tekijöistä ne, jotka liittyvät organisaatioon ja projekteihin. Niitä olivat organisaation tietojärjestelmien tila, organisaation kyvykkyydet sekä kulttuuri ja toimintaperiaatteet. Ne määräävät muun muassa tarvittavien muutosten laajuudeen, kyvyn valmistautua tulevaan ja adoptioon vaadittavan panostuksen. Näiden lisäksi luottamus nähtiin huomattavan arvokkaana onnistumiselle, sillä pilvipalvelujen adoptointi johtaa hallinnan määrän vähenemiseen tietojärjestelmästä, joka vaatii luottamusta. Työn arvo perustuu uudenlaisen tiedon esittämiseen liittyen pilvipalveluiden adoptoinnin tilaan Suomessa, näkemyksiin pilvipalveluista ja tekijöiden tärkeyteen. Tuloksia voidaan hyödyntää vertaillakseen organisaation pilvipalvelun adoptoinnin etenemistä muihin, vaikuttavien tekijöiden tarkastelemiseen sekä arvioimaan, mihin tekijöihin on hyvä kiinnittää huomiota pilvipalveluihin siirryttäessä tai niitä laajennettaessa.

Avainsanat: pilvi, pilvipalvelut, pilvipalveluiden adoptointi, tietojärjestelmien onnistuminen

PREFACE

This thesis has been a great lesson to learn. It has required stretching and living a little out of balance. However, it broadened my understanding about the cloud adoption which was definitely one of the targets. It has also brought back my missing concentration skills and has thought me more perseverance.

There are some people that have contributed to this work one way or another. Thanks to Professor Samuli Pekkola for his time and helpful guidance throughout the writing process. I want to also thank Annukka for the motivating subject, enthusiasm and support. Flexibility from her and others in the firm has given me time to concentrate and take this journey to the finish line in the fixed time. I would like to also express my gratitude for the interviewees and respondents who played crucial part for this work.

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Kaisla Pakkanen

CONTENTS

1. INTRODUCTION

This thesis was created as a part of knowledge and information management master's degree programme. Target of introduction chapter is to first present the background of the study and the motivational factors for it. Next the research scope and objectives are defined to represent the outlines and targets. For the final part the structure of the thesis is represented.

1.1 Background

Digital transformation has been one of the trends achieving attention during the past few years (Digital transformation 2019). One of the manifestations of digitalization is cloud transformation. It stands for systematic cloud adoption in order to adapt to the changes coming from inside or outside an organization. (Islam et al. 2013) Cloud services have been seen as an alternative for on-premise systems as they enable new kind of flexibility and adaptability without significant investments in advance (Low, Chen and Wu, 2011). Cloud is not anymore a new subject and its benefits have been discussed for years (Banerjee, 2009; Buyya et al., 2009; Low, Chen and Wu, 2011). However, based on Web of Science database it seems that the focus of literature has been more concentrated on the challenges, risks and barriers related to cloud.

Change from on-premise systems to cloud is not a simple task. Adoption of cloud affects the organization and it should be assessed how it influences for example the technologies, culture, processes and roles. Based on this it should be determined what needs to be done for the adoption to not fail. (Elson and Howell, 2009; Low, Chen and Wu, 2011) At least a decade ago adoption was not proceeding as quickly as it was expected (Banerjee, 2009; Buyya et al., 2009; Low, Chen and Wu, 2011).

Success seems to be quite ambiguous and extensive concept. It takes different shapes and sizes when it is related to projects and information systems. (Basten, Joosten and Mellis, 2011; Petter, DeLone and McLean, 2013) It can be approached from different angles. The targets of success can be very detailed and specific based on industry or they can be seen as more general which are applicable for wider examination of success. (Petter, DeLone and McLean, 2013; Misra et al., 2019) It is however clear that the success is the combination of various different factors (Petter, DeLone and McLean, 2013).

When examining the first 100 Andor search results for peer-reviewed articles with search phrase *("cloud adoption" OR "cloud computing adoption" OR "cloud service adoption")* couple of observations can be made. These articles seem to be related to few different areas. They either describe cloud adoption in some context, toolkits or models for cloud adoption, factors influencing the adoption, challenges or risks related to cloud or they go deep into the technical details.

There were similarities in articles that examined the factors related to cloud adoption. Low, Chen & Wu (2011) used technology-organizational-environmental (TOE) framework to understand the factors affecting cloud adoption in high-tech industry. Oliveira, Thomas & Espadanal (2014) used TOE and diffusion of innovation theory to examine the determinants in manufacturing and service sectors. Hsu, Ray & Li-Hsieh (2014) applied TOE framework to assess cloud adoption intention. Gangwar, Date & Ramaswamy (2015) utilized technology acceptance model (TAM) and TOE to understand the determinants of cloud adoption. There has been research about the cloud adoption at the firm or organizational level. However, the number of researches is not high. (Palos-Sanchez, Arenas-Marquez and Aguayo-Camacho, 2017) When complementing the search phrase with Finland it is seen that there is only one research connected to Finland, and it concentrates on the business opportunities of cloud in general (Ojala, 2016).

When using *“cloud adoption” AND success** as the search phrase, it is visible for the first 100 peer-reviewed articles that most of the articles concentrate on identifying barriers or fighting against the challenges and risks related to cloud. There are however a few articles that cover the factors affecting cloud adoption success. One article discusses the effect of IT capabilities on cloud computing success (Garrison, Wakefield and Kim, 2015). Another examines the realization of benefits that have been connected to cloud (Carcary et al., 2014). One of the articles considered the success factors of cloud adoption in a very specific industry (Misra et al., 2019).

1.2 Research objectives and scope

As mentioned, cloud has been around for years but there are not many public researches on cloud adoption in Finland. Based on Google and Andor searches publicly available materials that are related to Finland are restricted to reports from Statistics Finland and few dissertations related to cloud computing and their implementation in more general level or specified to a certain organization. Therefore, it is seen as valuable to know what the situation is with cloud adoption at the moment in Finnish organizations.

Based on comparison between European countries Finland is one of the leaders in using cloud service in companies (Cloud computing - statistics on the use by enterprises, 2018). This thesis is done in cooperation with firm X which team has been working on with subjects related to cloud transformation. This and the restricted information available motivates to find out more about the status of cloud service adoption in Finland. In addition to the status it would be also valuable to understand what kinds of matters have driven the adoption in Finnish organizations and what are the views of the organizations about cloud services. In addition, it is seen for example from change management point of view that successful transformation is not an easy and simple task. It would be therefore significant to understand what the foundation of cloud adoption success is and how it can be influenced.

Therefore, the basis for the research are cloud adoption, its status and success. Some more definitions have to be done in order to limit the extent of the thesis and to make sure that the research objectives are fulfilled. Adoption of technology can be examined from individual or organizational point of view (Oliveira and Martins, 2011; Oliveira, Thomas and Espadanal, 2014). As the purpose is to study the cloud adoption of the organizations the adoption is restricted to the organizational level in this research. From this point of view cloud adoption is seen as a process to assess, decide and implement cloud services (Zaltman, Duncan and Holbek, 1973).

As mentioned, success can be viewed from different points of views. In this work it is concentrated on the success of the system instead of just the project success. The research will be outlined to large Finnish public and private organizations to restrict the amount of organizations as the size is not constantly seen as impacting factor for cloud adoption (Gutierrez, Boukrami and Lumsden, 2015; Hsu and Lin, 2016; Loukis, Arvanitis and Kyriakou, 2017). Based on these decisions the research questions are derived:

- What is the status of cloud adoption in Finnish large organizations?
- What kinds of factors affect cloud adoption and how?
- What kinds of factors affect success of cloud adoption and how?

The main target of the thesis is to provide answers to the research questions. It is therefore important to select the most suitable research methods and techniques that support this objective. In addition, it is seen that it is significant to examine theoretical foundations and other literature related to the themes in order to support the design and conducting empirical study. To support fulfillment of the research objectives and value creation research needs to be conducted validly and reliably.

The thesis has been divided into nine chapters. This first chapter describes the research background, states the objectives and scope. The chapters from two to four cover the theoretical background and implications about the subjects related to the research. The second is dedicated to cloud, its definitions, characteristics and models. The third chapter represents theoretical foundations related to cloud adoption and findings that have been discovered in empirical studies on the subject. The fourth chapter and last section of the literature review covers theories and findings from literature related to the information systems success. In the chapters five and six the research methodology and decisions related to it are discussed. The fifth covers the theoretical foundation and sixth describes how the research was conducted. In the chapter seven the survey results are gone through, and in chapter eight the findings of the research are discussed. The last chapter nine summarizes the whole study, discusses its evaluation and examines the possibilities for future research.

2. CLOUD

There are not simple and established definitions for cloud and cloud computing even though the concepts have existed for years (Marston et al., 2011; Oliveira, Thomas and Espadanal, 2014). The term cloud derives from an idea that it is an infrastructure, a foundation for platforms and individual applications, that organizations and users can access from where and when ever needed as a service (Buyya et al., 2009; Low, Chen and Wu, 2011; Ryan, 2013; Pahl, Jamshidi and Zimmermann, 2018). According to Rajaraman (2014) cloud as a name developed from a cloudlike visualization for Internet connection.

There is one widely applied and accepted definition that is proposed by National Institute of Standards and Technology (NIST). NIST definition is seen to be valuable input to develop the understanding about the cloud-based technologies and services. (Ouahman, 2014) The definition of cloud computing is: “Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.” (Mell and Grance, 2011)

It must be noted that there is a difference between cloud and cloud computing. Based on Armburst et al. (2010) cloud concept covers the hardware and software in the datacenters and cloud computing covers also the applications that are provided via the Internet. However, based on Pahl et al. (2018) cloud contains technologies from hardware to platforms and applications which differs from Armburst et al. (2010) definition. This may indicate that the concepts and terminology are not that strict or coherently defined. The concepts of cloud and cloud computing seem to be widely defined through the features. This leaves an impression that cloud and cloud computing are sum of different objects or characteristics.

There are various cloud services that are provided for the organizations (Low, Chen and Wu, 2011). There are services for example for human resources, accounting, billing and invoicing, reporting and planning, inventory and supply chain management, sales, marketing, customer relationship management and collaboration (Gonzalez et al., 2011; Hogan et al., 2011; Tahamtan et al., 2012). Cloud services are seen for example to enable business agility, collaboration, reacting more quickly to changes, lowering costs and enhancing customer experience (Gong et al., 2010; Fremdt, Beck and Weber, 2013;

Weinman, 2015; Chen, 2017; Liu et al., 2018). These kinds of benefits are enabled through the cloud characteristics.

2.1 Cloud characteristics

In general, the foundation of cloud computing are virtualization and sharing of resources which enables IT service delivery via Internet on-demand (Hsu, Ray and Li-Hsieh, 2014; Chou, 2015). Resource pools form the core of the cloud and resource sharing. The purpose is that resources are effortlessly available and ready for use. They can be hardware, platforms or services, and the amount of their utilization can be adjusted on demand. This means that the scale of used resources can be adjusted at any time. (Vaquero et al., 2009; Hsu, Ray and Li-Hsieh, 2014) Deployment and assembly of cloud-based applications and platforms can be dynamically controlled as interdependent and adaptable systems in order to react to occurring changes (Pahl, Jamshidi and Zimmermann, 2018).

Even though there are various definitions for cloud and cloud computing the main features are recognized quite well throughout the literature. It has been suggested that there are five main characteristics of cloud computing: on-demand self-service, broad network access, resource pooling, rapid elasticity and measured service. (Mell and Grance, 2011; Xiao and Xiao, 2013; Ouahman, 2014) In addition to these characteristics in literature some other features such as scalability, agility, accessibility, virtual resources and pay-per-use are mentioned (Vaquero et al., 2009; Voorsluys, Broberg and Buyya, 2011; Bojanova, Xhang and Voas, 2013).

2.1.1 On-demand self-service

On-demand service and self-service require offering a possibility for customers to request, customize, utilize and compensate used services by themselves when needed (Mell and Grance, 2011; Xiao and Xiao, 2013; Ouahman, 2014). This means that the resources are available and accessible when required and obtaining them does not require a lot of trouble. Expectation is that consumer can access the computing capabilities when they need to without significant hold-up (Voorsluys, Broberg and Buyya, 2011). This enables independent procurement of resources such as storage or applications without personal interaction with service provider (Mell and Grance, 2011).

2.1.2 Broad network access

For broad network access terms easy-to-access standardized mechanisms and global reach capability have been used (Yakimenko et al., 2009; Hamdaqa and Tahvildari, 2012; Jula, Sundararajan and Othman, 2014). Broad network access character refers to cloud services being accessible through network, and connection is established with standardized methods that enable the use of mobile devices (Mell and Grance, 2011; Xiao and Xiao, 2013; Ouahman, 2014; Rajaraman, 2014).

In other words, broad network access represents situation where provided resources and services are located in various areas in the cloud and which all are available from different locations. It is possible to provision the resources and the services through standard mechanisms. (Jula, Sundararajan and Othman, 2014) This means that connection to services and resources is not tied to place or device.

2.1.3 Resource pooling

Concept of resource pooling is that the group of resources operate as if they were a single resource. Intention of the pooling is to increase reliability, flexibility and efficiency of the resources. (Wischik, Handley and Braun, 2008) In resource pooling the resources of service providers are divided into resource pools to serve multiple different customers. This kind of model is named multi-tenant model. In that resources – both physical and virtual – are divided dynamically based on the demand from the consumers. (Buyya et al., 2009; Mell and Grance, 2011; Xiao and Xiao, 2013; Ouahman, 2014).

Different kinds of resources are for example storage space, processing, memory, bandwidth of network or virtual machines (Mell and Grance, 2011; Xiao and Xiao, 2013). These resources can be geographically divided into multiple data centers (Rajaraman, 2014). However, consumer has rarely control over or even information about the exact resource location. Location may be specified on higher level such as geographic location or datacenter. (Mell and Grance, 2011) Customer can request for change in the resources based on their needs (Rajaraman, 2014).

2.1.4 Rapid elasticity

Expectation is that cloud makes it possible for resources to be provided at any time they are needed (Mell and Grance, 2011). Rapid elasticity indicates that cloud enables quick scalability of services (Mell and Grance, 2011; Xiao and Xiao, 2013; Ouahman, 2014). Capabilities can be arranged fast and elastically to enable scalability when needed. From the point of view of a consumer this scalability should not be restricted or dependent on

schedule (Mell and Grance, 2011; Xiao and Xiao, 2013) Cloud systems are adaptable and can automatically level out the load and optimize resource usage (Rajaraman, 2014).

Resources can be flexibly and quickly delivered and rearranged to revise the volume of used capabilities either up or down based on the demand from consumers. This scaling is managed by provisioning and releasing resources when application load surges or declines. (Mell and Grance, 2011). Provider's rapid elasticity of resources that follows variation of demand does not require consumers to forecast resources that may be needed in the future (Armburst et al., 2010).

2.1.5 Measured service

Service measurement enables automatic resource utilization controlling and optimizing in cloud (Mell and Grance, 2011). Monitoring of the service informs both provider and customer about resource utilization, its development and variation. Transparency of the service is enabled by monitoring of service use and reporting the exact usage. (Mell and Grance, 2011; Xiao and Xiao, 2013; Ouahman, 2014; Rajaraman, 2014)

Based on transparent monitoring customer can make changes to the ordered services and examine how the costs are accumulated. Metering may vary between the services. (Mell and Grance, 2011) Metering differs between resources and it can be based for example on the time that the service has been used, percentage of how much storage space is used or how much data is transferred per second. This depends also on the provider. (Anwar et al., 2015) Monitoring also enables pay-per-use model (Mell and Grance, 2011; Anwar et al., 2015). It means that through the model resources are used and use is compensated by paying for what has been used (Vaquero et al., 2009).

2.2 Service models

Cloud providers offer services from hardware resources to software services. Services can also contain Application Programming Interfaces (APIs) or tools for application development. (Voorsluys, Broberg and Buyya, 2011) Therefore, there can be different combinations available that vary from provider to provider (Hsu, Ray and Li-Hsieh, 2014). There is wide consensus that the cloud service models can be divided into three main categories: Software as a Service, Platform as a Service and Infrastructure as a Service (Mell and Grance, 2011; Voorsluys, Broberg and Buyya, 2011; Hsu, Ray and Li-Hsieh, 2014; Oliveira, Thomas and Espadanal, 2014; Chou, 2015).

2.2.1 Software as a Service

Software as a Service provides customers various applications that are run on service on provider's cloud infrastructure (Mell and Grance, 2011; Oliveira, Thomas and Espadanal, 2014; Chou, 2015). Applications can be seen as the highest level of cloud. Applications provided for users are available online as services without a need to locally install them. (Voorsluys, Broberg and Buyya, 2011) Thin client interfaces such as APIs or web browser interfaces are used to access the applications via variable mobile devices (Mell and Grance, 2011; Chou, 2015).

Consumers may be able to use application configuration settings based on the provided and often limited possibilities. However, the control over the cloud infrastructure including network, hardware, operating systems and application capabilities is still with the provider of the software. (Mell and Grance, 2011) This means that customer can only manage the provided applications as extensively as the provider allows them (Mell and Grance, 2011; Chou, 2015). Therefore, with SaaS customer gets the applications they need but main control over the operation is left for the service provider.

2.2.2 Platform as a Service

With Platform as a Service consumer receives an environment, set of tools and solutions via cloud for application creation and deployment (Voorsluys, Broberg and Buyya, 2011; Oliveira, Thomas and Espadanal, 2014; Chou, 2015). Platform enables deployment of created or acquired applications over the provided cloud infrastructure. Provider may also share collection of programming languages, services and tools for support. However, this does not always prevent the use of other languages or tools. (Mell and Grance, 2011)

Management and control over the infrastructure segments such as network, servers, operating systems and storage stays with the provider of the service. However, consumer is able to manage applications on the platform and possible settings of the environment where applications are hosted. (Mell and Grance, 2011; Chou, 2015) This means that Platform as a Service provides customer capabilities for application creation and deployment without having to take control over for example processing and storage management (Voorsluys, Broberg and Buyya, 2011). When compared to SaaS it is visible that control of the client increases along with extent of the service in use.

2.2.3 Infrastructure as a Service

Infrastructure as a Service is seen to be the basic representation of cloud (Sotomayor et al., 2009). It provides flexible computing resources that can be provisioned on demand (Sotomayor et al., 2009; Armburst et al., 2010; Mell and Grance, 2011; Voorsluys, Broberg and Buyya, 2011). IaaS enables the use of various operating systems and software collections (Voorsluys, Broberg and Buyya, 2011).

Cloud infrastructure consists of two layers: physical layer and abstraction layer. Physical layer represents collection of hardware resources such as server, storage space and network. They are required in order to support the operation of cloud services. Abstraction layer contains software that is needed for realization of cloud computing characteristics. Physical layer is the basis which operations are connected with abstraction layer by software deployment across collection of hardware for the creation of cloud infrastructure. (Mell and Grance, 2011)

Infrastructure represents hardware resources in cloud that are needed for processing, storage and network to be able to deploy and run selected software such as operating systems and applications. (Mell and Grance, 2011; Oliveira, Thomas and Espadanal, 2014; Chou, 2015) As the name indicates, with IaaS provider ensures that there is an operating cloud infrastructure available for use. At the same time the consumer can control items above it such as operating systems, storage and applications. (Mell and Grance, 2011) This model enables the ability for the customer to have extensive control over the applications, software and operating systems but the management of the hardware and other infrastructure can be left for the provider.

2.3 Deployment models

Originally the basis of the cloud was public computing utilities. However, other models have emerged due to varying physical locations and other restrictions. (Mell and Grance, 2011) Cloud has been divided in general into four deployment models. These deployment models are not dependent on the chosen service model. The deployment models of cloud are categorized as public, private, community and hybrid. (Mell and Grance, 2011; Rajaraman, 2014)

2.3.1 Public cloud

The idea of public cloud is that its infrastructure and computing resources are openly provided for general public (Mell and Grance, 2011). Generally, it is accessible for the

users with pay-per-use model (Armburst *et al.*, 2010; Chou, 2015). The foundation of the public cloud is that it is located on the premises of the provider. (Mell and Grance, 2011)

Owners, managers and operators of the public cloud can be private or public sector organizations or their combinations (Mell and Grance, 2011). As public cloud is widely available for use providers have to be prepared for uncertainties with highly flexible datacenters and infrastructures. As public cloud is available for access for a wide audience its content and functionalities must be thoroughly secured. (Chou, 2015) Public cloud is therefore the most unrestricted one from the deployment models as its user group is not specifically defined because its purpose is to be widely open for different kinds of consumers.

2.3.2 Community cloud

The foundation of community cloud is that its user group is a collection of organizations or their departments that create specific communities (Mell and Grance, 2011). Creation of community cloud can happen either inside or outside the community organizations (Chou, 2015). Owner, manager or operator of community cloud infrastructure is one or multiple organizations from the same community, one organization outside the community or their combination. The infrastructure can be hosted either on the premise or off the premise. (Mell and Grance, 2011)

The client organizations share the same concerns such as security requirements or regulation compliance (Mell and Grance, 2011). This means that inside a community parties should have common and set policies for cloud practices for example to minimize security concerns (Chou, 2015). Community cloud user group is therefore restricted based on the requirements of a community. Users and requirements therefore vary.

2.3.3 Private cloud

Private cloud infrastructure is not shared with the general public and is usually chosen by larger organizations (Armburst *et al.*, 2010). This is due to higher costs caused by need for staff, and infrastructure and data center maintenance (Chou, 2015). It is intended to be shared only within a single organization (Mell and Grance, 2011; Chou, 2015). Therefore, private cloud is owned, managed and operated by the organization itself, a third party or their combination. The infrastructure can be hosted either on or off-premises. (Mell and Grance, 2011) The service is shared internally via an intranet or a datacenter (Chou, 2015).

Private cloud does not necessarily need completely new foundation. It can be established by adding virtualization and interfaces to an existing infrastructure (Voorsluys, Broberg and Buyya, 2011). Service can contain capabilities for fault tolerance or security for enhancing the safety of operations and processes. Because of its limitations private cloud is seen to provide highly secure environment. (Chou, 2015)

2.3.4 Hybrid cloud

Hybrid cloud is a combination of the other deployment models: private, public and community cloud (Mell and Grance, 2011; Chou, 2015). However, Sotomayor et al. (2009) argue that hybrid cloud is combination of only public and private cloud. In hybrid cloud workload is provisioned into separate infrastructures on cloud based on requirements set by an organization (Chou, 2015).

In hybrid cloud infrastructures remain as individual components that are connected with technology to enable data and application interoperability for example for load balancing with capacity acquirement. (Mell and Grance, 2011) Example for hybrid cloud environment is when organization has a public cloud interface which is used for data transfer to private datacenter (Chou, 2015). Restrictions of hybrid cloud are therefore dependent on the chosen models and their features.

3. CLOUD ADOPTION

At organizational level technology adoption refers to a process during which an organization assesses the adoption of specific technology, makes the decision and implements it for use. It must be also noted that adoption on individual level happens after the implementation. (Zaltman, Duncan and Holbek, 1973) The individual's adoption is connected to perceived acceptance of the technology (Davis, 1989).

In general, technology itself is not the only part that is impacted when a new technology is introduced to an organization, and it is not the only driver of the adoption (Leavitt, 1965; Tornatzky and Fleischer, 1990). Adopting technologies and especially cloud services has a significant effect on organization as it may have direct influence on work and ways of working of the people. The organization itself has also impact on the intentions of adoption. (Tornatzky and Fleischer, 1990; Khajeh-Hosseini et al., 2012) In addition to technology and organization also environment influences cloud adoption. This means that external factors affect the organization's actions towards technologies. (Tornatzky and Fleischer, 1990) Technology adoption and also cloud adoption have been studied based on different models and theories. It has been found out that different kinds of factors from different contexts affect the organizations' move to cloud.

3.1 Cloud adoption models and theories

Based on literature there are two concepts that are highlighted more than others in the research on cloud adoption: diffusion of innovation theory (DOI) and technology-organization-environment (TOE) framework. (Oliveira and Martins, 2011; Oliveira, Thomas and Espadanal, 2014; Phaphoom et al., 2015) It is seen that these two complement each other as TOE contains environment context which is not included in DOI and diffusion of innovation factors are widely used as factors of TOE framework's technology context (Low, Chen and Wu, 2011; Oliveira and Martins, 2011; Oliveira, Thomas and Espadanal, 2014). It has been suggested that these two models should be used together to analyze cloud adoption (Espadanal and Oliveira, 2012).

There are other theories and frameworks that are widely exploited in cloud adoption research. Such theories are technology acceptance model, theory of planned behavior unified theory of acceptance and use of technology (Oliveira and Martins, 2011; Oliveira, Thomas and Espadanal, 2014; Phaphoom et al., 2015; Palos-Sanchez, Arenas-Marquez and Aguayo-Camacho, 2017). However, they concentrate on the individual's views on

adoption (Oliveira and Martins, 2011; Oliveira, Thomas and Espadanal, 2014). Therefore, they are not included in this thesis as the purpose is to concentrate on the organizational adoption of cloud computing.

3.1.1 Diffusion of innovation theory

Diffusion of innovation theory emerges from Roger's 1960s version which has been updated and developed by him until 2003. Its target is to clarify how, why and how well certain items such as ideas or technologies are spread out on both individual and organizational levels. (Rogers, 2003; Palos-Sanchez, Arenas-Marquez and Aguayo-Camacho, 2017) The basis of the theory are the characteristics of technology and individual's perceptions towards it (Espadanal and Oliveira, 2012).

Based on the theory there are certain innovation characteristics that determine the diffusion of innovation (Rogers, 2003). These variables are related to individual and leadership, internal organizational structure and external characteristics (Palos-Sanchez, Arenas-Marquez and Aguayo-Camacho, 2017). Individual characteristics and leadership refer to how change is received by leadership which represents their attitude towards it (Oliveira and Martins, 2011). Internal characteristics of organizational structure contain the characteristics connected to it: centralization, complexity, formalization, interconnectedness, organizational slack and size (Rogers, 2003). External characteristics describe the openness of the system (Oliveira and Martins, 2011).

For the internal organizational structure variable centralization describes the concentration of power and control in an organization. Organizational complexity refers to the knowledge and expertise level of the organization members. Formalization represents the expectations towards following rules and methods in organization. Interconnectedness illustrates how networks between people link separate groups inside an organization. Organizational slack describes the utilization of the resources and what is the amount of the resources that is available. Size refers to the size of the organization which is determined by the amount of employees. (Rogers, 2003)

Based on the analysis on diffusion of innovation it has been suggested that five factors influence the adoption of innovations. The factors are observability, complexity, relative advantage, compatibility and trialability. Observability represents the how results of the innovation can be seen such as if there are concrete outcomes or outputs for the use of the innovation. Complexity describes how hard it is to use and understand the innovation. Relative advantage explains how the innovation can benefit the organization. Compatibility describes how well existing business processes, practices, experiences and value systems are in line with the innovation. (Rogers, 2003) Trialability refers to the possibility

of the innovation to be experimented with beforehand (Rogers, 2003; Zhu et al., 2006). These affect the intention of adoption as presented in picture 1.

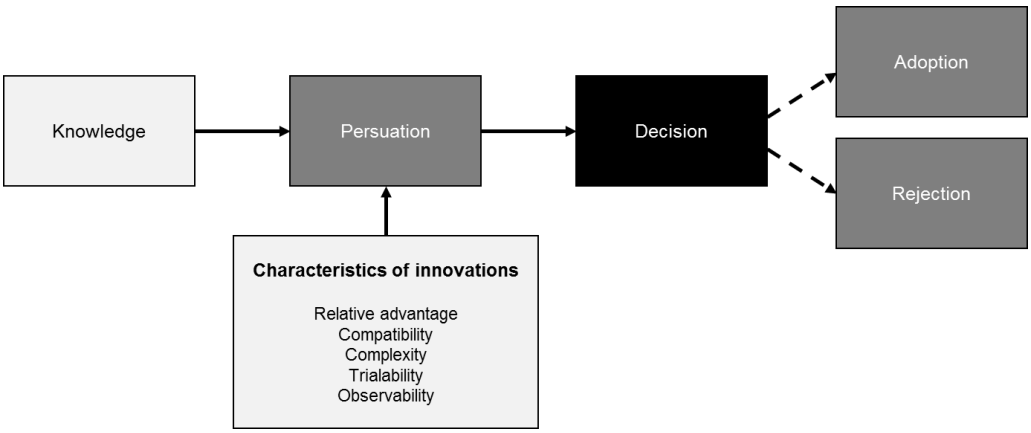

Figure 1. *Simplified version innovation-decision process* (Rogers, 2003)

As it is visualized in the picture DOI does not only concentrate on the adoption action itself. In the original decision process, there are five stages that affect the rate of innovation adoption. They are knowledge, persuasion, decision, implementation and confirmation. All five sections have their own variables. (Rogers, 2003) They however have not been highlighted in research on cloud adoption.

Based on the theory people tend to adopt new innovations in different pace. To describe the differences between people there are standardized categories for adopters. They are innovators, early adopters, early majority, late majority and laggards. Purpose of the division is that all adopters can be placed into one of the categories. (Rogers, 2003) The categories are presented below in figure 2.

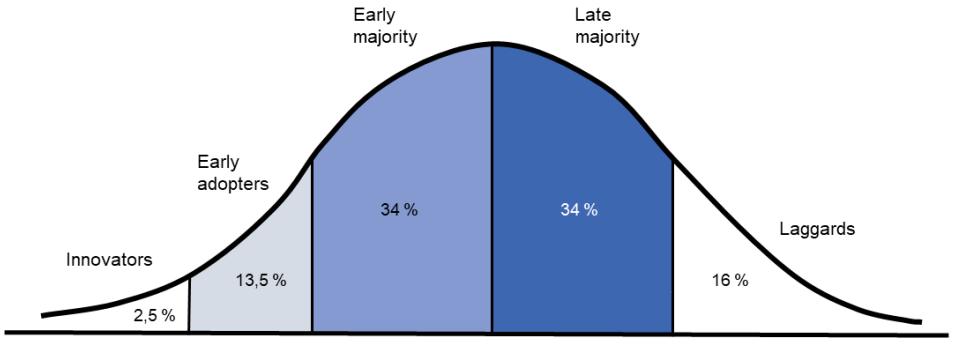

Figure 2. *Adopter categories* (Rogers, 2003)

As seen in the picture innovators are the smallest group of people who are excited to try new things and are willing to take risks and make quick decisions. Early adopters compose the second smallest group and they are open to new innovations but want to make more cautious decisions than innovators. Early majority is one of the two largest groups. People in this category require more time to process the adoption decision but are willing

to follow others. Late majority is the other biggest group. They tend to be skeptical towards new innovations and they need persuasion and peer-pressure to adopt. Laggards are the middle-sized group and the people are considered to resist innovations. They need watertight proof as they do not want to take risks. (Rogers, 2003) It must be noted that these categories have not been highlighted in cloud literature.

DOI is seen as valuable theory for understanding technology adoption (Zhu et al., 2006). However, the issue with the theory is that it concentrates on the context of innovation. Because of this it does not take into consideration many other factors that may influence organization's willingness to adopt technologies such as environmental factors (Lippert and Govindarajulu, 2006; Alam, 2009; Espadanal and Oliveira, 2012).

3.1.2 Technology-organization-environment framework

Based on the framework created by Tornatzky and Fleischer (1990) adoption of information technology in organization is affected by three contexts: technology, organization and environment. It was named based on this view as technology-organization-environment (TOE) framework. It is part of innovation process and describes how the contexts of the organization can affect the adoption of innovation. (Tornatzky and Fleischer, 1990; Baker, 2012) This is simplified in the picture 3.

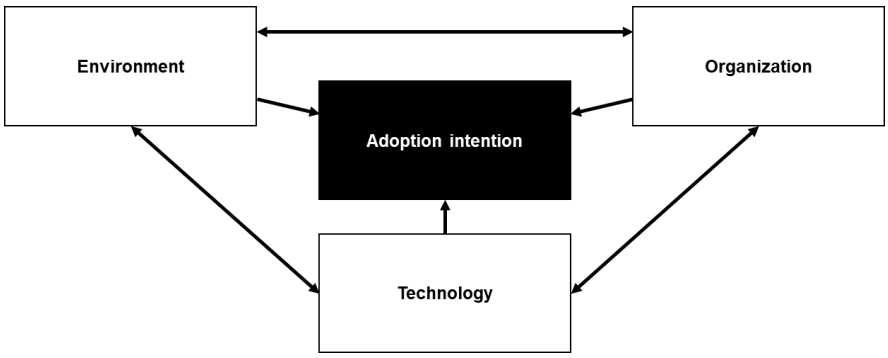

Figure 3. *Simplified version of TOE framework* (Baker, 2012)

The idea in the background is pictured in the figure and it is that these three contexts have influence on the intention to adopt technologies. At the same time they also affect each other instead of being individual and separate contexts. (Tornatzky and Fleischer, 1990; Baker, 2012) The intention of the framework is to examine adoption purely at organizational level (Baker, 2012; Palos-Sanchez, Arenas-Marquez and Aguayo-Camacho, 2017).

Technology context describes technologies available and applicable for the organization in addition to their characteristics (Tornatzky and Fleischer, 1990; Low, Chen and Wu, 2011; Oliveira and Martins, 2011; Oliveira, Thomas and Espadanal, 2014; Loukis,

Arvanitis and Kyriakou, 2017). This applies to both existing technologies inside organizations and technologies available outside an organization but which are not yet in its use (Baker, 2012). The technologies that are on hand have an effect on the adoption of new technologies as they affect the scope and progress of possible technological change (Collins, Hage and Hull, 1988). Existing technologies outside an organization also influence adoption by presenting new possibilities and restrictions for evolving and adaptation (Baker, 2012).

Technologies also determine what kind of change they bring along. Updating the technology with newer version usually creates incremental change which means that the existing technology remains basically the same but new features or versions are introduced. Synthetic change refers to situation where familiar or existing technologies are brought together to create something new. Discontinuous change introduces entirely new technologies that replace older innovations and technologies which can lead to major shifts in practices. (Baker, 2012)

Organization context takes into consideration the organizational resources and features such as utilization, organization size, leadership, scope and structure (Tornatzky and Fleischer, 1990; Oliveira and Martins, 2011; Baker, 2012; Loukis, Arvanitis and Kyriakou, 2017). Organizational structures affect the way new items are adopted and implemented to the everyday operations. It is also known that formal and informal relationships between people and teams along with communication processes can affect adoption. (Baker, 2012).

Environment context includes the organization's business environment that refers to the industry, service provider presence, competition landscape and regulations that are connected to the organization and its operation (Tornatzky and Fleischer, 1990; Baker, 2012; Oliveira, Thomas and Espadanal, 2014; Loukis, Arvanitis and Kyriakou, 2017). Initiation of changes and their speed are highly dependent on the environment of the organization. Industries which are considered mature or steady tend to be slower when it comes to adoption of new technologies compared to growing industries. (Tornatzky and Fleischer, 1990; Baker, 2012)

The TOE framework has been applied to studying the adoption of different kinds of technologies. However, it tends to vary which factors are used to represent the contexts in research. In general, it has been studied that all three contexts affect adoption of new technologies, but generally applicable set of variables has not been determined for adoption analysis. The factors used for the analysis vary and also does the significance of those factors. (Baker, 2012)

3.2 Determinants of cloud adoption

TOE framework as its basis is a basic model that does not describe the context factors influencing adoption directly. Therefore, the researchers have been selecting factors for the contexts to be tested. (Hsu and Lin, 2016; Loukis, Arvanitis and Kyriakou, 2017) The framework is seen to be in line with diffusion of innovation theory as the technology and organization contexts correspond to the drivers of organizational innovation (Wang, Wang and Yang, 2010; Low, Chen and Wu, 2011; Oliveira and Martins, 2011). Diffusion of innovation determinants have been successfully used in research with TOE framework with its complementary environment context (Hsu and Lin, 2016; Loukis, Arvanitis and Kyriakou, 2017). Factors that have been studied for their influence on cloud adoption are presented in table 1.

Table 1. *Factors presented in literature*

Context	***Factor***	***Significant / insignificant***	***References***
Technology	Relative advantage	(5 / 1)	(Low, Chen and Wu, 2011; Morgan and Conboy, 2013; Gangwar, Date and Ramaswamy, 2015; Gutierrez, Boukrami and Lumsden, 2015; Hsu and Lin, 2016; Hwang, Huang and Yang, 2016)
	Complexity / ease of use	(5 / 2)	(Low, Chen and Wu, 2011; Morgan and Conboy, 2013; Oliveira, Thomas and Espadanal, 2014; Gangwar, Date and Ramaswamy, 2015; Gutierrez, Boukrami and Lumsden, 2015; Hsu and Lin, 2016; Hwang, Huang and Yang, 2016)
	Compatibility	(3 / 4)	(Low, Chen and Wu, 2011; Morgan and Conboy, 2013; Oliveira, Thomas and Espadanal, 2014; Gangwar, Date and Ramaswamy, 2015; Gutierrez, Boukrami and Lumsden, 2015; Hsu and Lin, 2016; Hwang, Huang and Yang, 2016)
	Trialability	(1 / 2)	(Low, Chen and Wu, 2011; Morgan and Conboy, 2013; Hsu and Lin, 2016)
Organization	Top management support	(3 / 0)	(Low, Chen and Wu, 2011; Oliveira, Thomas and Espadanal, 2014; Gangwar, Date and Ramaswamy, 2015)
	Organization size	(3 / 3)	(Zhu et al., 2006; Oliveira, Thomas and Espadanal, 2014; Gutierrez, Boukrami and Lumsden, 2015; Loukis and Kyriakou, 2015; Hsu and Lin, 2016; Loukis, Arvanitis and Kyriakou, 2017)
	Readiness	(2 / 1)	(Low, Chen and Wu, 2011; Oliveira, Thomas and Espadanal, 2014; Gutierrez, Boukrami and Lumsden, 2015)
	Global scope	(1 / 2)	(Zhu et al., 2006; Espadanal and Oliveira, 2012; Hsu and Lin, 2016)
	IT skills and capability	(1 / 2)	(Low, Chen and Wu, 2011; Hsu, Ray and Li-Hsieh, 2014; Loukis, Arvanitis and Kyriakou, 2017)
Environment	Competitive pressure	(4 / 1)	(Low, Chen and Wu, 2011; Espadanal and Oliveira, 2012; Oliveira, Thomas and Espadanal, 2014; Gangwar, Date and Ramaswamy, 2015; Gutierrez, Boukrami and Lumsden, 2015; Hsu and Lin, 2016)
	Regulatory environment	(0 / 3)	(Espadanal and Oliveira, 2012; Oliveira, Thomas and Espadanal, 2014; Hsu and Lin, 2016)
	Partner pressure	(2 / 1)	(Low, Chen and Wu, 2011; Hsu, Ray and Li-Hsieh, 2014; Gutierrez, Boukrami and Lumsden, 2015)

It contains twelve factors that are mentioned at least in three research papers. Context column refers to the context category of the factor and the variable name is represented in Factor column. Significant / insignificant describes how many times the factor has been found to be significant or insignificant in the literature. References represent the sources where the factors have been studied. Based on the table content the factors that have been found to be either significant or well-represented in the literature with mixed results are relative advantage, complexity, compatibility, top management support, organization size, technology readiness, competitive pressure and partner pressure.

3.2.1 Technology factors

In literature it has been highlighted that relative advantage is a significant factor for cloud adoption (Low, Chen and Wu, 2011; Morgan and Conboy, 2013; Gangwar, Date and Ramaswamy, 2015; Hsu and Lin, 2016; Hwang, Huang and Yang, 2016). Cloud services are seen as beneficial technologies which drives their adoption (Gangwar, Date and Ramaswamy, 2015; Hsu and Lin, 2016). This may not be the case in all industries as it can be also seen as barrier due to its unclear charging models (Low, Chen and Wu, 2011). In one research it was determined that relative advantage is not a determinant for cloud adoption. However, it was not discussed why this may have been the case. (Gutierrez, Boukrami and Lumsden, 2015)

The significance of complexity has been well-supported (Morgan and Conboy, 2013; Oliveira, Thomas and Espadanal, 2014; Gangwar, Date and Ramaswamy, 2015; Gutierrez, Boukrami and Lumsden, 2015; Hwang, Huang and Yang, 2016). It must be noted that in some studies ease of use has been seen as opposite however, corresponding factor for complexity (Gangwar, Date and Ramaswamy, 2015; Hsu and Lin, 2016; Hwang, Huang and Yang, 2016). In two studies the results were that complexity is not significant factor for cloud adoption even though the previous studies indicated otherwise (Low, Chen and Wu, 2011; Hsu and Lin, 2016). When found significant complexity is seen to be a barrier for cloud adoption. This may be related to required standardization of processes. (Gutierrez, Boukrami and Lumsden, 2015)

Compatibility has received highly mixed results as three studies support its significance and four are against it. Compatibility has also received mixed results inside studies as well (Oliveira, Thomas and Espadanal, 2014). Compatibility is seen to affect relative advantage positively and therefore also cloud adoption itself (Hwang, Huang and Yang, 2016). In other study it was highlighted that the insignificance of compatibility may mean that the organizations seek new solutions that may not be automatically compatible with their existing technologies (Hsu and Lin, 2016).

3.2.2 Organizational factors

Top management support is the combination of supportive actions in the form of allocation of resources, encouragement and management's engagement to accomplish something (Guimaraes and Igbaria, 1997; Oliveira, Thomas and Espadanal, 2014). It has been studied that top management support is a significant factor for progress and accomplishment of information technology initiatives (Thong, Yap and Raman, 1996; Liang *et al.*, 2007). It has been also found to be significant determinant of cloud adoption as the management is able to drive initiations forward (Low, Chen and Wu, 2011; Oliveira, Thomas and Espadanal, 2014; Gangwar, Date and Ramaswamy, 2015).

Organization size results are mixed and half of the found studies found the factor to be significant and the other half did not. Size is seen to be significant as the large organizations may have the resources for the implementation and are able to take risks. Whereas small organizations tend to lack resources and are more hesitant to take risks. (Low, Chen and Wu, 2011; Oliveira, Thomas and Espadanal, 2014) However, when the size has been determined to be insignificant it has been suggested that it does not have effect on adoption as it is possible to determine the extent of services the organization needs (Hsu and Lin, 2016).

Readiness and competence refer to the state of technological infrastructure and IT human resources (Zhu et al., 2006; Low, Chen and Wu, 2011). Its results of significance are also mixed. Significance of readiness has been connected to the organizations being able to set realistic expectations about the challenges and what kind of capabilities are required for cloud adoption. (Oliveira, Thomas and Espadanal, 2014) When the technology readiness was found to be insignificant it was suggested to be related to the sample of the research. Participants had already adopted cloud services and therefore were unlikely to have major variance in the business processes. (Low, Chen and Wu, 2011)

3.2.3 Environment factors

Competitive pressure describes the pressure organization experiences from its competitors (Gatignon and S, 1989; Zhu et al., 2006; Low, Chen and Wu, 2011). Its significance is quite well supported, and it is brought up that it may refer to organizations tending to move to cloud more quickly in more competitive environments (Low, Chen and Wu, 2011). Insignificance of the competitive pressure was reasoned with that organizations do not yet understand the value of cloud services to realize its competitive advantage (Oliveira, Thomas and Espadanal, 2014).

Partner pressure refers to organization relying on its trading partners such as vendors (Pan and Jang, 2008; Low, Chen and Wu, 2011). In case of system vendors, significance of partner pressure for cloud adoption is reasoned with risk of locking down to unsupported legacy systems which should affect moving to cloud (Gutierrez, Boukrami and Lumsden, 2015). Also, its significance has been connected to situations where the organization does not have bargaining power over their partners, and they tend to accept the requests from them. The pressure can be also persuasive instead of coercion (Low, Chen and Wu, 2011).

3.3 Challenges

Cloud services are considered as dynamic and elastic opportunities for the organizations. However, there are also valid challenges or even barriers connected to them. (Khan and Malluhi, 2010) Especially security and privacy have been the major concerns connected to cloud during the past years (Phaphoom et al., 2015).

Security and privacy concerns derive from the action where the data and applications are taken into shared environment (Grossman, 2009; Takabi, Joshi and Ahn, 2010). This leads to situation that the control and responsibility over them are shared with the provider. At the same time this means that the customer's control over service decreases. (Takabi, Joshi and Ahn, 2010). It is valid risk that the service provider can access the data either on purpose or accidentally if the security measures do not fulfill the requirements (Grossman, 2009; Ryan, 2013; Xiao and Xiao, 2013). Also if the service and servers are located abroad more complex issues can occur as the applied laws and regulations may vary (Rajaraman, 2014).

Multitenancy is closely connected to security and privacy. Agility and elasticity of cloud services derive from dynamic resource utilization and which is enabled by multitenancy model. It means that the environment is shared with different customers. (Takabi, Joshi and Ahn, 2010) In shared environment secure authentication, encryption and risk of one client endangering the others by their actions must be taken into account (Grossman, 2009; Rajaraman, 2014). The same issues are connected to virtual servers as the data from different clients can be located in single server in data center which hosts multiple other servers (Braithwaite and Woodman, 2011; Abed and Chavan, 2019).

One of the major challenges is the customers' dependence on the service and its provider (Braithwaite and Woodman, 2011). Issues related to this are a concern for keeping up the service quality including security and availability of the service (Braithwaite and

Woodman, 2011; Rajaraman, 2014). The dependency increases with the extent of outsourced services (Braithwaite and Woodman, 2011).

Related to the dependency there are also challenges that are connected to availability of the service and lack of standards. Reliability and resiliency are the key factors of availability and they determine if the customer is able to use the service on-demand. (Moreno-Vozmediano, Montero and Llorente, 2013) Lack of standards has been highlighted as challenge already years ago and it is seen as a reason for not to move to cloud (Lin and Chen, 2012). Still it is seen that consistency and lack of standards are issues that should be addressed. They affect the interoperability of the cloud services and increases the risk of vendor lock-in. (Kaur, Sood and Kaur, 2017; Ünver, 2019) Issues come up especially when there is a need to switch service provider and it is not as easy as the agility of cloud is trying to pursue (Rajaraman, 2014).

Cloud services are seen as a cost-efficient choice. However, the issue is that also other costs in addition to running and maintenance costs should be considered. (Lin and Chen, 2012; Avram, 2014) Pay-per-use model enables the transparency in the costs of the services. However, in advance it is hard to assess the costs as the billing models may vary by providers and the usage may vary monthly (Khajeh-Hosseini et al., 2012). In addition, the costs connected to switching providers are considered high (Phaphoom et al., 2015).

4. INFORMATION SYSTEMS SUCCESS

In general success is the positive outcome and measure of succeeding (*Success*, 2019). It is considered a success when the set targets have been accomplished (Stevenson, 2010c). The success can be therefore seen as something that is aimed for by accomplishing something. Based on the literary there is not a universal definition for the information systems success, and it has been an issue. Information systems success is seen more as a result of the determinant factors. (Petter, DeLone and McLean, 2013) Overall information systems success is evaluated from a stakeholder's point of view on how well the system serves them (Seddon, 1997).

A widely used model for understanding information systems (IS) success was created by DeLone and McLean (1992). The original version contained six IS success variables: system quality, information quality, use, user satisfaction, individual impact, and organizational impact (DeLone and McLean, 1992). The variables are dependent on each other to measure success (Petter, DeLone and McLean, 2013). Updated version of the framework was published later on to include service quality, and net benefits to replace individual impact and organizational impact, and divide use into use and intention to use (DeLone and McLean, 2003).

Even though the framework has been seen to be useful it has lacked specific factors to describe the variables in more detailed level. New model for IS success was created based on the former model and Leavitt's diamond for organizational change. (Petter, DeLone and McLean, 2013) Leavitt's model describes how introducing new technology in organization has impact on tasks, people and structure, and vice versa (Leavitt, 1965). The new model of IS success states that tasks, people and structure are the factors that determine technology success (Petter, DeLone and McLean, 2013).

4.1 Information system success variables

The success of information system consists of multiple factors that all affect the performance. They are system quality, information quality, service quality, intention to use, use, user satisfaction and net benefits. (DeLone and McLean, 1992; Petter, DeLone and McLean, 2013). In the figure 4 the factors and their relationships are represented.

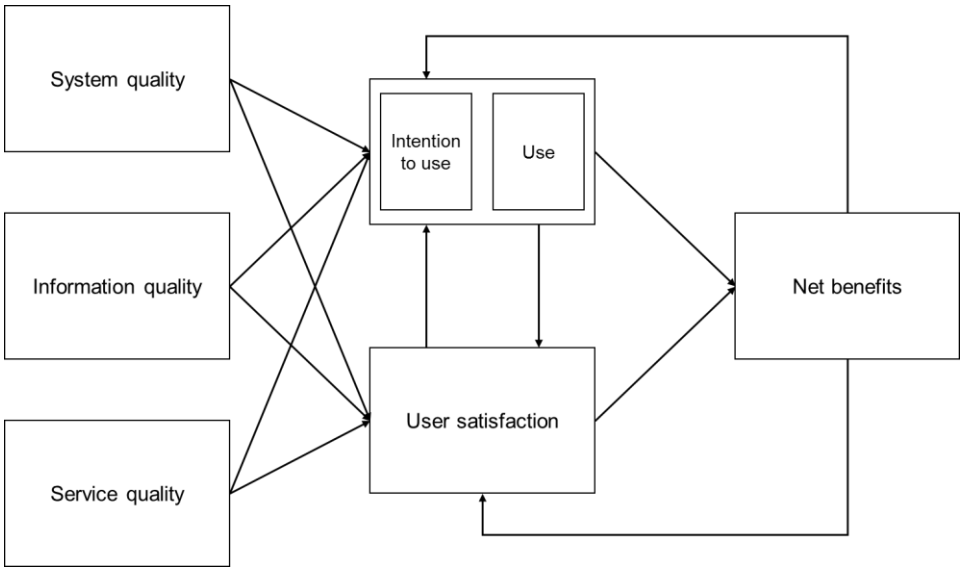

Figure 4. *Information systems success variables and their dependence* (DeLone and McLean, 2003)

As mentioned, the quality has been divided into three dimensions: system, information and service quality. They all affect the intention to use and user satisfaction separately and together. (DeLone and McLean, 2003). Quality affects user's intention to continue using the system (Zheng, Zhao and Stulianou, 2013). The use and user satisfaction influence the net benefits which have impact on the intention to use and user satisfaction (DeLone and McLean, 2003). In the next few sections these variables will be covered more thoroughly.

4.1.1 System quality

In one definition system quality is considered equal to information processing quality. This is dependent on cutting-edge technology, functionalities, user friendliness and easy maintainability. (Gorla, Somers and Wong, 2010) In other one it is seen that the system quality summarizes the user perceptions that are created based on the interaction with the system (Nelson, Todd and Wixom, 2005).

System quality consists of multiple technical factors that have impact on the overall quality (Petter and McLean, 2009; Petter, DeLone and McLean, 2013). Based on Bailey and Pearson (1983) there are four system quality factors: convenience of access, flexibility, integration and response time. Nelson et al. (2005) add reliability in addition to the mentioned ones. Sabherwal et al. (2006) summarize that system quality characteristics are reliability, response time and ease of use. Based on Petter et al. (2013) accessibility, functionality, reliability, response time, sophistication, flexibility, and navigability affect system quality. All factors and their definitions are presented in the table 2.

Table 2. *System quality factors*

Factor	***Definition***	***Source***
Accessibility	Effort needed to access	(Bailey and Pearson, 1983; Miller, 1996; Wang and Strong, 1996; Nelson, Todd and Wixom, 2005)
Ease of use	Effort needed to use	(Davis, 1989)
Flexibility	Adaptability to various user and environment requirements	(Bailey and Pearson, 1983; Wang and Strong, 1996; Nelson, Todd and Wixom, 2005)
Integration	Supporting retrieval of information from various sources for decision-making	(Bailey and Pearson, 1983; Miller, 1996; Wang and Strong, 1996; Nelson, Todd and Wixom, 2005)
Response time	Quickness of response to requests	(Bailey and Pearson, 1983; Ives, Olson and Baroudi, 1989; Nelson, Todd and Wixom, 2005)
Reliability	Dependability over time	(Srinivasan, 1985; Nelson, Todd and Wixom, 2005)
Sophistication	Features based on the perspective of end users	(Gorla, Somers and Wong, 2010)
Navigability	Efficiency and easiness of finding information	(Fang *et al.*, 2012)
Functionality	Evaluated capabilities and operations	(Stevenson, 2010b)

As it is visible in the table the factors of the system quality are related to the system content, usability and expectations towards it. Based on the definitions most of the factors rely on human evaluation about their state. Only a few factors can be considered to be more technical such as integration and response time.

It is seen that system quality influences system use (Sabherwal, Jeyaraj and Chowa, 2006). System quality perception can be influenced with training and user participation (Sabherwal, Jeyaraj and Chowa, 2006; Petter, DeLone and McLean, 2013). Overall, system quality affects the user experience positively through effective design and management (Zheng, Zhao and Stulianou, 2013)

4.1.2 Information quality

System quality is complemented with information quality (Zheng, Zhao and Stulianou, 2013). The information quality describes the quality of information system outputs. The quality depends on for example how useful, accurate, relevant and understandable the outputs are. (Petter and McLean, 2009; Gorla, Somers and Wong, 2010; Petter, DeLone and McLean, 2013) It is seen that quality of information is the basis for creditable decision

making and favorable outcomes (Petter, DeLone and McLean, 2013). It is seen that information quality affects the usability of information for business decisions (Petter, DeLone and McLean, 2013; Zheng, Zhao and Stulianou, 2013).

Based on Bailey and Pearson (1983) information quality factors are accuracy, precision, currency, timeliness, reliability, completeness, conciseness, format and relevance. Nelson et al. (2005) leave out precision, timeliness, reliability, conciseness, and relevance from their definition. Petter and McLean (2009), and Petter et al. (2013) add sufficiency and understandability to Bailey and Pearson's factors and leave out reliability, completeness, format and relevance. These factors and their definitions are presented in the table 3.

Table 3. *Information quality factors*

Factor	***Definition***	***Source***
Accuracy	Correspondence to the real world	(Ballou and Pazer, 1985; Fisher and Kingma, 2001; Nelson, Todd and Wixom, 2005)
Precision	Level of detail	(Bailey and Pearson, 1983; Sebastian-Coleman, 2013, p. 108)
Currency	Representation of current state in a set context	(Bailey and Pearson, 1983; Ives, Olson and Baroudi, 1989; Cappiello and Francalanci, 2003; Nelson, Todd and Wixom, 2005)
Timeliness	Availability at a given time	(Bailey and Pearson, 1983)
Reliability	Consistency and trustworthiness	(Bailey and Pearson, 1983)
Completeness	Comprehensive representation of an entity in a set context	(Bailey and Pearson, 1983; Ballou and Pazer, 1985; Fisher and Kingma, 2001; Nelson, Todd and Wixom, 2005)
Conciseness	Simplicity and clarity of the content structure	(Bailey and Pearson, 1983; Kahn, Strong and Wang, 2002; Nelson, Todd and Wixom, 2005)
Format	Representation supporting understandability and interpretability	(Bailey and Pearson, 1983; Miller, 1996; Lee *et al.*, 2002; Nelson, Todd and Wixom, 2005)
Relevance	Applicability and helpfulness	(Kahn, Strong and Wang, 2002; Bovee, Srivastava and Mak, 2003; Nelson, Todd and Wixom, 2005)
Sufficiency	Adequateness for a given purpose	(Stevenson, 2010d; Sebastian-Coleman, 2013, p. 82)
Understandability	Comprehensibility	(Kahn, Strong and Wang, 2002)

It is visible from the table the factors are related to information content and structure. Even though some of the factors such as accuracy and precision, and currency and timeliness may be close to each other, the definitions still highlight their differences. Themes that seem to be represented throughout the factors are clarity, correspondence

and detail. It must be noted that there are various different kinds of descriptions, frameworks and methodologies for information quality and therefore there may be some factors left missing from the list.

Information quality is seen as a major determinant of use and net benefits. It is also critical item of the overall quality and decision making. Multiple factors affect information quality but it is not yet clear what are the effects. (Petter, DeLone and McLean, 2013)

4.1.3 Service quality

Service quality describes level of user support provided by the organization's own IS department or external service providers when compared to the expectations (DeLone and McLean, 2003; Gorla, Somers and Wong, 2010). Good level of service has been accomplished if user's perceptions on the performance are in line with the expectations (Gorla and Somers, 2014). Factors affecting the service quality are reliability, responsiveness, assurance and empathy (Petter and McLean, 2009; Gorla, Somers and Wong, 2010; Petter, DeLone and McLean, 2013).

Reliability of the service represents the ability to serve dependably and accurately (Pitt, Watson and Kavan, 1995). Responsiveness describes service provider's willingness to help and serve when. Assurance refers to capabilities of the service providers to create trust and improve the confidence of the users. Empathy represents the attention and care expressed by the service provider (Pitt, Watson and Kavan, 1995; Gorla, Somers and Wong, 2010).

Service quality is highlighted especially in situations where the information systems services are provided by external operators (Gorla and Somers, 2014). Enhancing service quality can lead to strategic advances through efficient and effective management of internal resources. Overall IT quality has major influence on how organizations can create value from information systems. (Gorla, Somers and Wong, 2010) Value of systems can be enhanced through improvement of service quality (Gorla and Somers, 2014). Based on literature service quality affects IS success through use and user satisfaction (Pitt, Watson and Kavan, 1995).

4.1.4 Intention to use

Background of intention to use is in behavioral intention concept from theory of planned behavior. It must be however noted that the foundation of the theory is based on the theory of reasoned action. Both theories deal with the human behavior and the drivers behind their actions. Intention is seen to represent the factors that motivate behavior. It

describes the effort that person is willing to take to accomplish something. The higher person's intention is, the more likely they will go through with it. (Ajzen, 1991)

Success of information system is dependent on that it is used in a way and for the purpose that it was created. Intention of use or likelihood to use the system is an important variable as measuring use itself is not always realistic. (Petter, DeLone and McLean, 2013) Intention to use describes the expectations towards the use of system or its outputs (Petter and McLean, 2009). It is seen to represent IS success well as intention is required for user to use the system. If there is lack of intention, it affects directly system use negatively. (Mardiana, Tjakraatmadja and Aprianingsih, 2015)

Intention to use is tied to an individual, but usage can be analyzed both in the individual and organizational level (Petter, DeLone and McLean, 2013; Mardiana, Tjakraatmadja and Aprianingsih, 2015). Intention to use is significantly influenced by the user's attitude toward technology (Petter, DeLone and McLean, 2013). The intention to use is seen as attitude whereas the use itself is an active behavior (DeLone and McLean, 2003).

4.1.5 Use

Definitions of use seem to be quite high level which may tell about how hard it is to describe what the use is. Seddon (1997) summarizes the use as using the system. Sabherwal et al. (2006) define use as the effort of individual's put in to using the system. Petter and McLean (2009) see use as the consumption of information system or its output. Based on Zheng et al. (2013) use is the actual usage of the system.

Overall system use depends on the nature, extent, quality and appropriateness of use. These can be used to assess if the system is being used the way it has been intended. (DeLone and McLean, 2003) Also, duration, depth and frequency are factors that can be used to evaluate the actual usage (Zheng, Zhao and Stulianou, 2013). Petter, DeLone and McLean (2013) gather that the use variables contain frequency, depth, duration, and appropriateness of use, system dependence, actual use and self-reported use. Use can be measured in time using the system or its outputs, frequency, users or two dimensional way: using and not using (Seddon, 1997). The factors and their definitions are gathered to the table 4.

Table 4. *Use variables and their definitions*

Variable	***Definition***	***Source***
Frequency of use	How often system is used?	(Venkatesh *et al.*, 2008)
Extent / depth of use	How thoroughly system key features are utilized?	(Kuo-Chung, Lie and Ming-Liang, 2010)
Duration of use	How much time is spent for system use?	(Venkatesh *et al.*, 2008)
Appropriateness of use	How proper system use is in a context?	(Stevenson, 2010a)
System dependence	How well system integrates to work routines?	(Goodhue and Thompson, 1995)
Actual use	Monitored system usage	(Ettema, 1985; Deane, Podd and Henderson, 1998)
Self-reported use	User's assessment about their system usage	(Ettema, 1985; Deane, Podd and Henderson, 1998)

Based on the variable definitions all factors seem to represent system usage in different ways. Frequency and duration seem to be the simplest ones from the factors and express how they are measured. Extent and appropriateness of use and system dependence are more complex factors. They are closely related to the system context and expectations that have been set for usage. The last two stand out from the first ones and they represent the way of estimation or measurement of the system usage.

System use has been closely examined throughout the years. It is dependent on organizational competence, extrinsic motivation, IT infrastructure, attitudes toward technology, management processes and support, and task compatibility. (Petter, DeLone and McLean, 2013) This refers to that use is complicated action that is impacted by various different factors.

4.1.6 User Satisfaction

Satisfaction is seen as user's perception on how well the system meets their requirements (Sabherwal, Jeyaraj and Chowa, 2006; Quality management systems, 2015). This can be also summarized to approval or likeability towards a system (Petter and McLean, 2009). Satisfaction in a given situation is the sum of one's feelings or attitudes toward a variety of factors affecting that situation (Bailey and Pearson, 1983).

Based on the definitions it is visible that satisfaction is subjective assessment about the system outcome (Seddon, 1997). As satisfaction is tied to an individual's beliefs and attitudes, it is not easy to determine the building blocks of user satisfaction. It is usually

measured by assessing the beliefs connected to system and information characteristics. (Wixom and Todd, 2005)

User satisfaction has been widely studied (DeLone and McLean, 2003; Wixom and Todd, 2005; Petter, DeLone and McLean, 2013). It has been closely connected to the acceptance and system use (DeLone and McLean, 2003; Wixom and Todd, 2005; Petter, DeLone and McLean, 2013). Task compatibility and attitudes toward technology are considered to be determinants of user satisfaction. (Petter, DeLone and McLean, 2013)

4.1.7 Net benefits

Net benefits are the sum of system impact on individuals, groups, organizations, industries and societies. They can be assessed for example with performance, perceived usefulness and effect on practices. (Petter and McLean, 2009) Benefits can be explored on different levels from individual to organization and outside the organization (DeLone and McLean, 1992).

Net benefits are seen as a sum of all benefits and costs, both bygone and upcoming, that are related to the information system use. Costs cover all use of resources that have been or will be used for implementing, learning and using the system. To be able to assess the net benefits, stakeholders' point of view must be considered to analyze the values. (Seddon, 1997) Benefits of IT can be for example improvement in decision making based on the received accurate and timely information (Gorla, Somers and Wong, 2010).

Impacts that is the net benefits are dependent on system and its purposes (DeLone and McLean, 2003). From the organization point of view target of implementing an information system is for example to increase profitability or productivity. Based on literature sophistication of the IT infrastructure and management support affect the organizational benefits such as cost savings and financial performance. (Petter, DeLone and McLean, 2013)

4.2 Determinants of information systems success

Based on Petter et al. (2013) there are characteristics that are considered to be determinants of information system success. They influence either directly or indirectly the variables of the information system success and therefore influence the whole success of the information system success. The determinants of information systems success are divided into three categories: task, project and organizational, and user and social characteristics. (DeLone and McLean, 1992, 2003; Petter, DeLone and McLean, 2013)

Task characteristics represent the Task in Leavitt's diamond model, user and social characteristics the People, and project and organizational characteristics represent the Structure. IS success variables represent the technology construct. (Leavitt, 1965; Petter, DeLone and McLean, 2013) The characteristics and their categorization are presented in the figure 5.

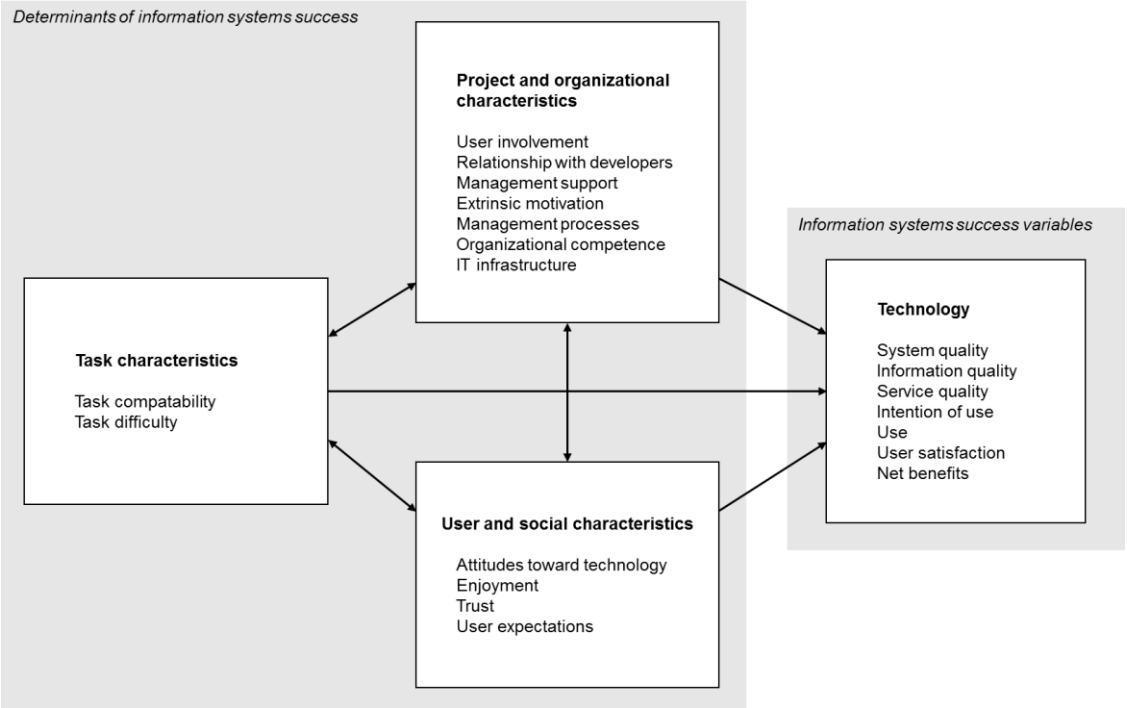

Figure 5. *Information system success determinants and variables* (Petter, DeLone and McLean, 2013)

As seen in the picture the task characteristics which are task compatibility and difficulty affect the success variables directly and indirectly. This applies also to project, organizational, user and social characteristics. As described the characteristics also have impact on each other. In the next section they are described.

4.2.1 Task characteristics

The first category of determinants is task characteristics. The tasks are seen as pieces of work which purpose is to contribute to organization's operation. The intention of information systems is to support these activities. (Leavitt, 1965) Task characteristics contain two determinants: compatibility and difficulty (Petter, DeLone and McLean, 2013). Task compatibility describes how well the technology is in line with the processes and methods (Taylor and Todd, 1995; Petter, DeLone and McLean, 2013). Based on literature the task compatibility affects the individual impact, use and user satisfaction (Petter, DeLone and McLean, 2013).

Task difficulty describes how easy it is to analyze and predict the work that is being considered (Gelderman, 2002). User satisfaction and individual impact as part of net benefits are dependent on the difficulty of the task (Gelderman, 2002; Petter, DeLone and McLean, 2013). Task difficulty is seen to be dependent more on the individual's perception than the whole organization's as same task can be seen as difficult for other and easy for another (McKeen, Guimaraes and Wetherbe, 1994). IS success increases when the task is considered easy and simple (Petter, DeLone and McLean, 2013).

4.2.2 User and social characteristics

People are the major part of the organization and they influence information system success (Leavitt, 1965; Petter, DeLone and McLean, 2013). There are four types of user and social characteristics that affect IS success: attitudes toward technology, enjoyment, trust and user expectations (Petter, DeLone and McLean, 2013).

Attitudes toward technology are seen as users' thoughts on the technology and its use (Sabherwal, Jeyaraj and Chowa, 2006). In general attitudes have strong influence on system use (Keen, 1981). Attitudes toward technology have been seen to affect intention to use, use, system quality, and indirectly user satisfaction and individual impact. Enjoyment represents the positive side of the attitudes. (Petter, DeLone and McLean, 2013)

Trust is seen as the combination of specific beliefs towards subject's goodwill and competences. The subject can be for example another party such a vendor or the system itself. (Giffin, 1967; Gefen and Silver, 1999; Heiskanen, Newman and Erklin, 2008) Trust in the system and vendor have a positive impact on the system use (Nicolaou and McKnight, 2006; Petter, DeLone and McLean, 2013).

User expectations represent user's beliefs about the eventual information system performance and its use when it is ready for operation (Lawrence and Low, 1993; Szajna and Scamell, 1993). It is seen that if the expectations are considered reasonable it affects IS success positively (Staples, Wong and Seddon, 2002; Petter, DeLone and McLean, 2013). Based on literature reasonable expectations lead to more satisfied users. Therefore, expectation management is crucial. (Petter, DeLone and McLean, 2013)

4.2.3 Project and organizational characteristics

Structures represent the informal and formal structures, relationships, patterns of the organization (Leavitt, 1965). Project characteristics refer to the structures for management of IS development and updates. Organizational characteristics are in general as-

pects of organization that can affect the IS success There are seven project and organizational characteristics that affect IS success: user involvement, relationship with developers, management support, extrinsic motivation, management processes, organizational competence and sophistication of IT infrastructure. (Petter, DeLone and McLean, 2013)

User involvement represents the participation of the future users in development project (Marble, 2003). The involvement contains users' assignments and behaviors during implementation project or users' feelings of involvement (Sabherwal, Jeyaraj and Chowa, 2006). Based on literature user involvement affects use and user satisfaction in addition to individual and organizational impact (Petter, DeLone and McLean, 2013).

Relationship with developers refers to the relationship between the future users of the system and the people working for its development and implementation (Petter, DeLone and McLean, 2013). Communication between user and developer influences positively the user satisfaction (McKeen, Guimaraes and Wetherbe, 1994). Maintenance of the relationship requires partnership, sharing knowledge, trust and continuous communication throughout the project. (Petter, DeLone and McLean, 2013)

Management support is seen as favorable and encouraging attitude of the management towards an information system and its use (Sabherwal, Jeyaraj and Chowa, 2006). It is represented through allocation of time and resources for the information system development, implementation and use, in addition to the visible encouragement from the management. Management support has found to affect the use, individual and organizational impacts. (Petter, DeLone and McLean, 2013)

Extrinsic motivation in general represents incentives coming from outside of an individual to increase the motivation to do something (Bénabou and Tirole, 2003; Petter, DeLone and McLean, 2013). Incentives can be for example reward which target is to increase the use of information system. Extrinsic motivation has been seen as a strong driver of the system use. (Petter, DeLone and McLean, 2013)

Management processes can be seen as coordination mechanisms which intention is to either reinforce existing structures or develop them to create suitable environment for new information systems (Chatterjee, Grewal and Sambamurty, 2002). They represent organizational structures, systems and methods such as culture, bureaucracy and change management. Actions connected to management processes are seen to affect the system use and net benefits when the processes are adopted in organization. These kinds of operations are for example encouragement of open discussion and communication about the IS benefits. (Petter, DeLone and McLean, 2013)

In general, organizational competence refers to management's knowledge on information systems (Petter, DeLone and McLean, 2013). It must be noted the both IT and business related knowledge are crucial for creating strategic value from the information systems (Armstrong and Sambamurthy, 1999). It affects the adoption of IS and its use (Boyton, Zmud and Jacobs, 1994; Caldeira and Ward, 2002; Petter, DeLone and McLean, 2013).

Sophistication of IT infrastructure represents how well the key information technologies support the business applications (Chatterjee, Grewal and Sambamurty, 2002). That is how well the organization can apply its technological resources to create business value (Barua *et al.*, 2004). The sophistication affects the information quality, use and organization impacts as part of the net benefits. (Petter, DeLone and McLean, 2013)

5. RESEARCH METHODOLOGY

The nature of the research can be divided into philosophy, approach, strategy, choice and time horizon (Saunders, Lewis and Thornhill, 2009, p. 108). The decisions for these are explained in this section starting with the philosophy. The chosen research philosophy for the thesis is pragmatism which basis is the research question. The purpose is to choose the most suitable set of methodology to find the answers. (Saunders, Lewis and Thornhill, 2009, p. 109) Pragmatism is chosen as the research questions are seen to be the foundation of the research and the main goal is to be able to answer them while using the suitable methods.

The plan for research approach is to apply deduction. The foundation of deductive approach is the theory from which hypothesis is formed. Formed hypothesis is then tested. (Saunders, Lewis and Thornhill, 2009, pp. 124–125) Deduction is suitable approach for master's thesis as the purpose is to gather background information in addition to empirical research which can be used to confirm findings from literature review.

Literature review will support gathering information about the theoretical background and formulating a hypothesis in addition to answering the research questions. Empirical survey strategy is chosen to test the hypothesis and to answer the questions. The named strategy is common choice for explanatory studies (Saunders, Lewis and Thornhill, 2009, p. 362). Intention of explanatory research is to study relationships between variables (Saunders, Lewis and Thornhill, 2009, pp. 140–141). Survey makes it possible to gather data from wider group of people in a limited time than for example interviews. Also, surveys enable to gather the data in more standardized format which can be then analyzed quantitatively. (Saunders et al. 2009, p. 144)

As the survey has been chosen to be the main method to collect data mono method approach is taken. Mono method describes approach where the data collected with the survey will not be complemented with other quantitative data. (Saunders, Lewis and Thornhill, 2009, pp. 151–152) Validative interviews will be used to develop the questionnaires but they will be considered as secondary method and will not be used to gather data for result analysis.

Time horizon chosen for the research is cross-sectional. Its purpose is to provide a snapshot for the research topic at specific moment (Saunders et al. 2009, p. 186). This choice is based on the research questions and to be able to review the situation at the moment. The object is more a phenomenon that for example a specific project and its progress

that could be studied over time. Survey strategy is also often chosen for these kind of studies (Robson 2002; Easterby-Smith et al. 2008).

5.1 Survey

Producing a quantitative representation of study population is the target of survey strategy (Fowler, 2009, p. 1). One of the most popular categories for survey is questionnaire (Saunders, Lewis and Thornhill, 2009, p. 361). It describes techniques that are used to gather data in a way that all participants are expected to answer the same questions in a fixed order (de Vaus, 2002). Because of this questionnaire is seen as an efficient way for data collection from large sample to conduct quantitative analysis (Saunders, Lewis and Thornhill, 2009, p. 361).

Even though surveys are seen as a great way to collect data, it must be noted the questionnaire has major impact on reliability, validity and response rate (Saunders, Lewis and Thornhill, 2009, p. 362). To carry out surveys validly and reliably few items need to be considered carefully. They are sampling, design and data collection. (Fowler, 2009, p. 4)

5.1.1 Sampling

Sampling includes features such as technique, frame, size, design and response rate which all have effect on survey reliability (Fowler, 2009, p. 7). There are two main techniques to choose from: probability and non-probability sampling. Difference between these is that with the latter sample is chosen instead of using random selection. (Saunders, Lewis and Thornhill, 2009, p. 213) They can also be called as random and systematic sampling (Fowler, 2009). Non-probability technique is chosen in order to receive valid data from the survey. Therefore, the sample cannot be randomly selected from organizations. This is based on the fact that the respondent must have knowledge about information technologies used in the organization.

Non-probability sampling can be further divided into quota, purposive, snowball, self-selection and convenience (Saunders, Lewis and Thornhill, 2009, p. 213). In order to gather responses from the targeted group of people there must be a way to contact them. Therefore, ability to gather contact details has an effect on the final sample size. Self-selection sampling is one of the sampling techniques to support this kind of situation. It describes a technique where the need for the data is expressed to a group and data collection relies on people responding to the need. (Saunders, Lewis and Thornhill, 2009, p. 213)

Sample frame describes an interest group based on research targets (Fowler, 2009, p. 8). It is important part of sampling as it should form the representative group from the population that is being studied. The frame therefore affects the representativeness of the sample. (Pinsonneault and Kraemer, 1993)

When compared to probability sampling guidance for sample size is not clear or strict (Saunders, Lewis and Thornhill, 2009, p. 233). Size is dependent on research target and objectives (Patton, 2002). Non-probability samples are usually used for deriving generalization for theory instead of a population. Ability to contact the sample chosen has influence of the sample size and it is important to assess what is realistic. (Saunders, Lewis and Thornhill, 2009, pp. 233–243) Sample size and its selection determine how widely the results can be generalized and what is the level of confidence for data and results (Saunders, Lewis and Thornhill, 2009, p. 365)

Sample design describes plan for selecting the final target for the survey (Fowler, 2009, p. 7). This means that for example deciding which organizations and people are chosen to be part of the respondent group. The choice should be done based on the research target and what kind of information is collected. It should be noted if the survey should target specific people in organizations instead of all employees of organizations. If the information that is required is more detailed it is wise to contact specific people that are expected to know the area. (Fowler, 2009, p. 35)

Response rate is seen to be influenced by the data collection method and also what is expected from the respondent. Email survey response rate depends on the target audience and purpose of the survey. (Fowler, 2009, pp. 75–76). It must be noted that response rate for survey describes the context for comparison of the results. It does not indicate that higher than normal rate would mean that the responses are unbiased (Rogelberg and Stanton, 2007) and the contrary would not indicate that they are biased (Saunders, Lewis and Thornhill, 2009, p. 365). Expectation for response rate varies between 10-30 percent for self-administered questionnaires (Saunders, Lewis and Thornhill, 2009, p. 364).

5.1.2 Survey design

Response rate, and reliability and validity of collected data are influenced by the questionnaire design. These can be enhanced with careful planning of questions and layout, description of purpose, testing, and execution of survey. (Saunders, Lewis and Thornhill, 2009, p. 361)

When using survey as primary research method it needs to be ensured that accurate data will be gathered. This is a requirement as it is used for answering the determined research questions. Usually there are no other possibilities to request additional information from the respondents later on or clarify their thinking. (Saunders, Lewis and Thornhill, 2009, p. 361)

Questions can be either open or closed (Fowler, 2009, p. 100; Saunders, Lewis and Thornhill, 2009, p. 374). With open questions it is not restricted in which way respondents have to answer the questions (Fink, 2003a; Fowler, 2009, p. 100). Open questions can be exploited if detailed answers or clarifications for the respondent's thoughts are needed (Saunders, Lewis and Thornhill, 2009, p. 375). They also enable collecting answers that were not expected. However, they do not sometimes provide valid data for research. (Fowler, 2009, p. 101)

Purpose of closed questions is that the way of answering is restricted. This enables respondents to have the same expectations on what the appropriate answers are for a question. (Fowler, 2009, pp. 96–97) In closed questions respondent must choose the answer from the choices that are given to them. They tend to be quicker to answer and the answers are easier to compare than open questions. Closed questions can be categorized to list, category, ranking, rating, quantity and matrix questions. (Saunders, Lewis and Thornhill, 2009, p. 375) With closed questions respondents are requested to fit themselves or their organization into given categories or rates or to provide a number (Fowler, 2009, p. 100).

Questions providing consistent measures and that measure what is intended are reliable and valid hence, good questions (Fowler, 2009, p. 77). Questions can be developed from scratch or they can be adopted or adapted from the literature to be able to compare the results with earlier research. Exploiting tested questions also allows to evaluate reliability. Validity is improved with well-defined and clear questions. (Saunders, Lewis and Thornhill, 2009, p. 374). Applying simple and short words is the basic and valid approach for designing questions. It is also important to avoid using terms that can be understood in different ways. (Fowler, 2009, p. 92)

Structure of the questionnaire should be designed in a way that order and flow are coherent. Designing questionnaire structure is based on the ordering of questions. It is usual that the simplest questions are placed in the beginning. They are followed with questions that may need more thought. (Fowler, 2009, p. 120) Flow of the questionnaire can be controlled with filter questions that determine if the following questions are appli-

cable to the respondent. If not, they can be automatically skipped. However, it is suggested that these kind of questions are used maximum three times as filtering questions can be seen as annoying. (Saunders, Lewis and Thornhill, 2009, p. 387) Flow can be influenced with grouping similar questions to not give an impression that the order of the questions is chosen randomly or that respondents need to go back to keep track (Fowler, 2009, p. 124).

Format of the questionnaire must also be consistent with the data collection method (Fowler, 2009, p. 76). It has significance for both self- and interview-administered surveys. It should motivate the respondent to finish it. (Saunders, Lewis and Thornhill, 2009, p. 388) When it comes to the length it should not excessively affect the layout. It is suggested to concentrate more on the clarity of the format than the length. (de Vaus, 2002; Dillman, 2007) The target of the format design is to ease the task of the respondent as much as possible to enhance the response rate (Fowler, 2009, p. 120).

5.1.3 Validative interview

It is recommended to test questionnaire before its distribution (Saunders, Lewis and Thornhill, 2009, p. 394). Purpose is to test that there are not challenges for respondents to consistently understand and answer the questions (Fowler, 2009, p. 118; Saunders, Lewis and Thornhill, 2009, p. 394). This way the questions can be assessed from the respondent point of view and problematic questions can be enhanced (Fowler, 2009, p. 6). Trough the test it is also possible to evaluate if the required data can be gathered with the choice of questions (Saunders, Lewis and Thornhill, 2009, p. 394).

Piloting can be done by sharing the questionnaire with people from the chosen sample. After the completion they are requested to answer questions regarding the filled questionnaire. (Fowler, 2009, p. 124) Research questions, objectives and size in addition to available resources determine how many people should be interviewed for the questionnaire testing (Saunders, Lewis and Thornhill, 2009, p. 394).

For the pilot testing finished questionnaires should be reviewed. It should be assessed if the data indicates that the respondent has been able to answer questions and follow the instructions (Fink, 2003b). Explanatory questions should be asked from the respondents to understand what they experienced during the questionnaire. It should be found out if there were any unclear or challenging questions. In addition, time it took to complete the questionnaire, clarity of instructions, and comments about layout and structure should established. (Bell, 2005; Fowler, 2009, p. 124) It is also possible for the interviewer to

gather information about how questions were understood and answered by the respondent. This way it can be examined if the questions fill their purpose and they measure what they should. (Fowler, 2009, p. 119)

5.1.4 Data collection

After preparations it is time for administering the questionnaire in order to collect data (Saunders, Lewis and Thornhill, 2009, p. 395). Ways to organize questionnaires can be divided into two main categories: self and interview administered. There are three types of self-administered questionnaires and they are internet-mediated, postal, and delivery and collection. Interview-administered can be categorized to telephone-administered and structured interview. (Saunders, Lewis and Thornhill, 2009, p. 363) Type of questionnaire that is the most suitable for the research is dependable of research question, objectives and target group (Fowler, 2009; Saunders, Lewis and Thornhill, 2009, p. 366).

If the purpose is to target specific people with internet-mediated survey, email is a good way to do this (Saunders, Lewis and Thornhill, 2009, p. 363). Administering a survey by email requires contact details, cover letter, clear instructions, possible tool for questionnaire and follow-ups. (Fowler, 2009; Saunders, Lewis and Thornhill, 2009, pp. 395–398) Cover letter shared with the questionnaire should indicate the purpose of the research and why response is important (Saunders, Lewis and Thornhill, 2009, p. 389). Intention of the letter is to catch the attention and motivate to participate in the survey (Dillman, 2007; Saunders, Lewis and Thornhill, 2009, p. 395).

Instructions shared for the recipient should inform the schedule and requirements expected from them. It must be clear for them what they need to do and when. It is usual to provide contact details for the recipients. (Saunders, Lewis and Thornhill, 2009, pp. 391–395) There are multiple tools for conducting surveys that can be used for questionnaire design, data collection and data analysis. One this type of tool is SurveyMonkey.com. (Saunders, Lewis and Thornhill, 2009, p. 365)

Follow-ups are efficient way to increase the response rate. First reminder should be sent with the covering letter after one week from the first contact. It should be sent for all and it should include acknowledgement for the recipients that have filled the survey. Additional follow-ups should be conducted if time allows and more responses are required. (Saunders, Lewis and Thornhill, 2009, p. 397)

5.2 Data analysis

When the data has been collected it is time to start analyzing it for the results and conclusions (Fowler, 2009, p. 155; Saunders, Lewis and Thornhill, 2009, p. 416). Data analysis process for quantitative data can be divided into four main subtasks: data preparation, presenting, describing and examining relationships. These subtasks are further divided into smaller sections. (Saunders, Lewis and Thornhill, 2009, p. 416)

Data preparation can be divided into formatting, coding and cleaning data (Fowler, 2009, p. 145). For data analysis it is important to ensure that the collected data is in a format that is easy to use for analysis. It should be clear how data is organized in the file and what are the separate cases. (Fowler, 2009, p. 146) Some data collection tools automatically gather data to a file where one line represents one case that is the answers given by single respondent. (Saunders, Lewis and Thornhill, 2009) It must be noted that data analysis tools vary on how the data should be formatted for analysis. However, there are usually some similarities such as that the case identifiers are located in the beginning of the file. (Fowler, 2009, p. 146)

Before data analysis responses must be grouped and coded (Saunders, Lewis and Thornhill, 2009, p. 385). Coding describes setting the rules on how the responses will be translated to standardized values that can be further analyzed with tools (Fowler, 2009, p. 145). Intention is to assign numerical values to the answers to differentiate them from each other. Coding therefore can vary a lot between questions depending on their type. (Saunders, Lewis and Thornhill, 2009, p. 422)

For rating scales, coding starts from 1 in numerical order. The values depend on the amount of choices. The same applies to the coding of category questions. (Saunders, Lewis and Thornhill, 2009, p. 386) However, it must be taken into account that category questions have to be formatted differently to scaled items (Saunders, Lewis and Thornhill, 2009, p. 426). Missing data must be considered in coding (Fowler, 2009, p. 146). There are four reasons for missing data: data not required from respondent, non-response by choice, not knowing the answer or having an opinion, or mistakenly missing data. Their difference must be taken into account if needed in coding. (Saunders, Lewis and Thornhill, 2009, p. 425)

After coding and before continuing to the analysis itself data cleanup needs to be done (Fowler, 2009, p. 151). Cleaning refers to checking the data to find errors or deprivations resulted from coding, entry or completion (Rowley, 2014). The intention is to verify that the retrieved and prepared data is complete and in-line (Fowler, 2009, p. 152). Checking

errors mitigates the risk of false results deriving from bad quality data (Saunders, Lewis and Thornhill, 2009, p. 427).

After preparations the next step is to start analyzing (Fowler, 2009, p. 155; Saunders, Lewis and Thornhill, 2009, p. 428). Before further analysis it is important to understand the data that is being treated as it guides selection of techniques (Saunders, Lewis and Thornhill, 2009, p. 428). Variance in data types require variance in the analysis techniques (Rowley, 2014). Exploration and presentation of data can for example describe frequency, distribution, proportions or comparisons of variables and their values (Saunders, Lewis and Thornhill, 2009, pp. 429–439). These provide means to summarize data and present values in simple ways (Blaikie, 2003, p. 52).

Describing data refers to the analysis done with descriptive and graphic methods to represent numeral summaries on the data (Sonnad, 2002; Saunders, Lewis and Thornhill, 2009, p. 444). Descriptive analysis usually studies totals, proportions, averages and spread (Rowley, 2014). Central tendency and dispersion are the main aspects for descriptive statistics (Saunders, Lewis and Thornhill, 2009, p. 444). Central tendency concentrates on central and common values, while dispersion concentrates on variability of the values. There are different tools to describing these aspects (Sonnad, 2002; Saunders, Lewis and Thornhill, 2009, p. 444)

Mode, median and mean are the most common ways to describe the centric values. Mode describes the most frequently represented value in the data. Median represents the middle point of data when it has been set in order. Mean or average refers to the calculated value that derives from the sum of values being divided with the amount of observations. (Sonnad, 2002; Saunders, Lewis and Thornhill, 2009, p. 444) However, it must be noted that mean should only be calculated for variables with continuous values (Fisher and Marshall, 2009; Saunders, Lewis and Thornhill, 2009, p. 445). One of the main techniques for dispersion analysis is standard deviation. Standard deviation refers to how much the values differ from mean (Saunders, Lewis and Thornhill, 2009, p. 447). However, it must be noted that mean should only be calculated for variables with continuous values (Fisher and Marshall, 2009; Saunders, Lewis and Thornhill, 2009, p. 445). Distribution of values can be analyzed to compare the importance of variables based on respondent point of view (Phaphoom et al., 2015).

Examining relationships is the final fourth step for the data analysis (Saunders, Lewis and Thornhill, 2009, p. 449). It is also known as explanatory analysis or bivariate analysis (Blaikie, 2003, p. 47; Rowley, 2014). It usually contains the testing of relationships and assessing their significance and strength (Blaikie, 2003, p. 47; Saunders, Lewis and

Thornhill, 2009, p. 449). Testing the significance refers to analyzing variables relatedness to another variable. It helps to find out if results derive from random variation instead of statistical significance. (Saunders, Lewis and Thornhill, 2009, p. 449)

Relationship significance is dependent on sample size as it is hard to results indicating significance within small samples. Increase in sample size increases the statistical significance of the relationship. (Saunders, Lewis and Thornhill, 2009, p. 450) Relationship strength of variables can be analyzed for example with Spearman's rank correlation coefficient, Kendall's rank order correlation coefficient or Pearson's r depending on the data type (Saunders, Lewis and Thornhill, 2009, p. 451; Rowley, 2014).

Correlation refers to phenomenon where change in variable affects correlating variable (Saunders, Lewis and Thornhill, 2009, p. 459; Rowley, 2014). Correlation coefficient describes relationship strength from value -1 to +1 where negative values indicate negative relationship and vice versa. Correlation value closer to the limiting values refers to a stronger relationship. Significance is analyzed with probability that states if the probability of correlation has happened only by chance. (Saunders, Lewis and Thornhill, 2009, p. 459)

6. EMPIRICAL STUDY

The target of the empirical study was to seek answers to the first research question in addition to providing content for the other two to test hypothesis from the Finnish organization point of view. Achievement of these goals were considered in the creation of the survey and data analysis. Study process was divided into subtasks literature review, survey creation and testing, data collection, analysis and results, discussion and conclusions. This high-level process and progress are represented in the figure 6.

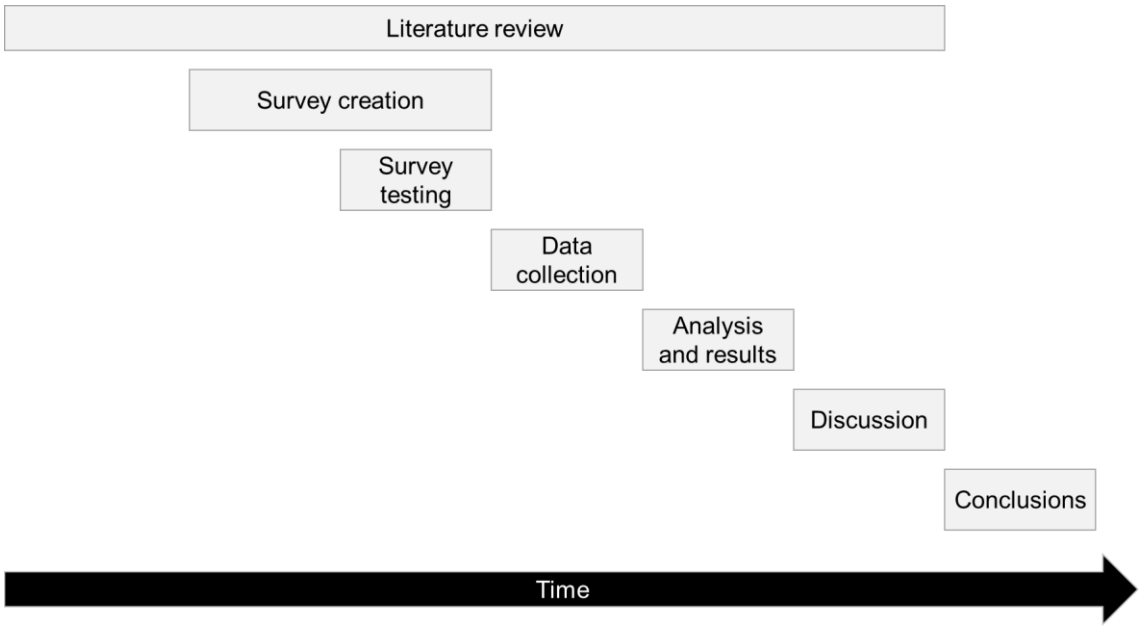

Figure 6. *Process for the empirical study*

Theory section on cloud, cloud adoption and information systems success were created based on the literature review. Materials were also used as a basis for survey and questionnaire creation, data analysis and discussion. Survey was created based on the empirical research done on the subject and complemented with additional questions. Survey was tested before sending it to the potential respondents. Based on the feedback the survey was developed and finalized.

Data was collected with the survey from the IT representatives of large Finnish organizations during few weeks' time as self-administered and internet mediated distribution. This was due to the restricted time frame and to be able to reach as many organizations as possible. Analysis of the data concentrated on the descriptive methods to highlight the main findings. Results section covered the main results based on the data analysis.

Discussion considered the main findings and implications from them. Conclusions concentrated on summarizing and evaluation of the study.

6.1 Survey

For the survey questionnaire was created to gather quantitative data from the respondents. In order to complete the survey reliably and validly best practices were applied to sampling, survey design and data collection. These all were done while keeping in mind the research targets.

6.1.1 Sampling

Intention of the survey was to get insights about the determinants of successful cloud adoption and state of cloud adoption in large Finnish organizations. Therefore, the survey sample was restricted to large private and public organizations that operated officially in Finland. Large companies are considered to have more than 250 employees and minimum 50 million in yearly turnover (*Small and medium size enterprises*, 2019). Operation of public organizations is not equivalent to private organizations. Therefore, it was decided that the employee limit would determine the size for these organizations.

Non-probability technique was used for the survey. This choice was based on evaluation that the survey sample cannot be randomly selected from the organizations. It was seen that respondents must have to have a high-level view on the information technologies used in the organization. Self-selection sampling was chosen as it was planned to use email invitations for the survey. This means that intention was to contact people from the chosen sample based on the contact list that was gathered. The persons themselves were able to decide if they wanted to answer the questionnaire based on the given information.

Large Finnish organizations were the context of the survey and therefore, the employees of these kind of organizations were chosen to be contacted. However, it needed to be addressed that all people from the organizations would not have been able to give reliable answers. People from IT units were assessed to have the knowledge to provide required data for answering the research questions. It was estimated that realistic amount of contact details that could be gathered from sources during set time frame would be between 200-300. In total 259 people were contacted from 200 different organizations to request for their responses.

In total 37 responses were gathered with the survey. From that amount 32 responses were finalized and contained answers to all required questions. Therefore, the response

rate of the survey was 12,4 %. This rate is in the range of expected response rate for internet-mediated questionnaire. The amount of answers is likely to be mainly affected by the length and target group. 20 minutes survey for busy employees can be major reason to not take part.

6.1.2 Survey design

Designing survey started with reviewing literature on what kind of empirical research had been done and what kind of questions were used for these themes. Intention of the survey was to address three subjects based on the research questions: cloud adoption state, cloud adoption determinants and success determinants. Intention of the questionnaire structure was to support logical order of the subjects. Questionnaire is represented in Appendix B.

All questions in the questionnaire were closed questions apart from the open text field questions at the end. This choice was made in order to ease the comparability of the answers, ensure data quality and decrease amount of time it took to respond to the survey. Category questions were used to gather background information. All questions related to cloud adoption determinants were chosen to be rated using fixed 5-point rating scale. For success determinants it was chosen to use a matrix question as the same rating scale was used for all of them.

Design of the survey started based on the themes. The questionnaire was therefore divided into five sections that are in order background, cloud adoption state, cloud adoption determinants, cloud adoption success and personalized report. Purpose of the first section was to gather information about the respondent's and their organization's background. That is why category questions for respondent's responsibility area and organization industry were included. Cloud adoption state section continued gathering the background information on what is the organization's cloud adoption state, what is the respondents experience on cloud providers and if something has been or will be moved to cloud. This was done to collect data on cloud adoption in the organizations.

Cloud adoption section was divided into four sections: technology, organization, environment and items viewed as challenges or barriers in the literature. In order to select the suitable questions and limit the length of the questionnaire cloud adoption determinants were delimited. Relative advantage, ease of use / complexity and compatibility were chosen for technology context. Top management support, and competence and readiness were chosen for organization context as size was left out as the purpose was to target only large organizations. Competitive and partner pressure were chosen for environment

context. The choices were based on the literature review. The table 5 represents the articles which questions were applied to the questionnaire.

Table 5. *Chosen questions and their sources*

Variables	***Reference***
Background	(*Toimialaluokitus*, 2008; Evans, 2018)
Cloud adoption	(Thiesse et al., 2011; Espadanal and Oliveira, 2012; Hsu, Ray and Li-Hsieh, 2014; Oliveira, Thomas and Espadanal, 2014)
Relative advantage	(Zhu et al., 2006; Espadanal and Oliveira, 2012; Hsu, Ray and Li-Hsieh, 2014; Oliveira, Thomas and Espadanal, 2014; Hsu and Lin, 2016)
Compatibility	(Zhu et al., 2006; Low, Chen and Wu, 2011; Thiesse et al., 2011; Espadanal and Oliveira, 2012; Lin and Chen, 2012; Oliveira, Thomas and Espadanal, 2014; Gangwar, Date and Ramaswamy, 2015; Gutierrez, Boukrami and Lumsden, 2015; Hsu and Lin, 2016)
Complexity / ease of use	(Zhu et al., 2006; Low, Chen and Wu, 2011; Espadanal and Oliveira, 2012; Lin and Chen, 2012; Hsu, Ray and Li-Hsieh, 2014; Oliveira, Thomas and Espadanal, 2014; Gangwar, Date and Ramaswamy, 2015; Gutierrez, Boukrami and Lumsden, 2015; Hsu and Lin, 2016; Palos-Sanchez, Arenas-Marquez and Aguayo-Camacho, 2017)
Competence and readiness	(Low, Chen and Wu, 2011; Espadanal and Oliveira, 2012; Oliveira, Thomas and Espadanal, 2014; Gangwar, Date and Ramaswamy, 2015; Gutierrez, Boukrami and Lumsden, 2015)
Top management support	(Low, Chen and Wu, 2011; Espadanal and Oliveira, 2012; Oliveira, Thomas and Espadanal, 2014; Gangwar, Date and Ramaswamy, 2015; Gutierrez, Boukrami and Lumsden, 2015; Palos-Sanchez, Arenas-Marquez and Aguayo-Camacho, 2017)
Competitive pressure	(Zhu et al., 2006; Low, Chen and Wu, 2011; Espadanal and Oliveira, 2012; Hsu, Ray and Li-Hsieh, 2014; Oliveira, Thomas and Espadanal, 2014; Gangwar, Date and Ramaswamy, 2015; Gutierrez, Boukrami and Lumsden, 2015)
Partner pressure	(Zhu et al., 2006; Hsu, Ray and Li-Hsieh, 2014)

Most of the questions used in the section on cloud adoption determinants were gathered from articles on that subject. These were complemented with ones from technology adoption literature. As there were seven determinants that were highlighted in the questionnaire in addition to the other sections, it was decided that two or three questions per determinant were used. In literature usually 2-5 measurements were used per subject which was in line with the choice. Questions from literature were chosen based on evaluation on their representativeness, clarity, and level of detail. The chosen questions were considered to represent well the determinant, express the same level.

For relative advantage business operation agility, operation productivity, customer experience and operational costs were addressed. Compatibility covered technology matching with organization's processes and architecture changes. Complexity and ease of use questions related to the usability and customizability of the services. IT readiness and

competence covered resources and capabilities. Top management support addressed the understanding and support of the management towards cloud services. Competitive and partner pressure questions covered the state of cloud adoption and possible impacts.

Adoption success section was created based on the determinants of information systems success. Many of the empirical surveys about the matter studied the relationship between the factors and success or the determinants in very detailed level. Therefore, it was decided that the determinant definitions were used to form a matrix question for respondents to assess importance of the individual factors. Questions from literature were accompanied with created questions based on the literary such as the ones related to background, cloud adoption, relative advantage or partner pressure.

It was decided that the measures should be as neutral as possible in order to avoid leading the respondents with too positive or negative questions. Based on this they were formatted as neutral arguments that would be evaluated with rating scales with both negative and positive choices. Some of the measurements from literature were divided into two separate items to ensure that they would only acknowledge one item at a time. This was done to avoid situations where respondent could agree with one of the items but disagree with the other. Generally, all statements were formatted in a way that it does not matter if respondent's organization has or has not adopted cloud services. Final order of the questions was based on the grouping of determinants and aim of placing questions with same scales after another.

6.1.3 Validative interview

The questionnaire was tested before sending it to the survey sample. This was done with a secondary research method: validative interview. The purpose of the interview was to validate the questionnaire content and its structure before executing the survey. Preparation of interview required contacting potential testers, arranging time for the testing and interview, and creating testable version of the survey.

Two persons from the target group agreed to test the questionnaire and give an interview based on it. Before testing with them the original version of the questionnaire was developed based on the feedback from three other persons outside the target group who had views on the subject. These choices were done based on the limited time that was available for the survey creation, testing and execution.

Testing was arranged as follows. During separate Skype interviews testers were given short introduction which contained the same information as in the drafted cover letter.

Then they were asked to fill out the questionnaire. Testers were requested to give feedback or ask questions throughout the exercise. After the completion of the questionnaire testers were asked to give their feedback on the questions, structure, guidance and length. The questions that were addressed are presented in the Appendix A. Not all questions were asked if they had already come up during the testing.

The questionnaire was not touched between the testing and feedback sessions and all changes were done based on the overall feedback that was gathered. Changes that were done were related to the survey guidance, wording of the questions and response choices. Also, three questions were added to the beginning to gather background information about the respondents and their organizations if they did not want to leave their contact details to receive a personalized report.

6.1.4 Data collection

Survey Monkey was used for data collection as it provided simple and easy to use tools for questionnaire creation and its distribution. Questions, response choices and guidance were typed in and format of them was modified based on the plan. Survey Monkey enabled some level of customization in the terms of question types, guidance texts and flexibility for questionnaire distribution via email with a link. For example, logic functionalities were used to enable some questions to become visible based on the respondent's answer. Survey Monkey was also cost efficient and did not require additional payments. As the data to be collected with the survey was estimated to be quantitative, it was known that Survey Monkey enabled it to be retrieved in excel format that could be further analyzed.

It was decided that the survey would be distributed via email to be able to target specific people that would fit in the target group. In order to do this contact list was required. Available contact details and open sources were used to gather a list of people that could be considered to be valid respondents for the survey. The selection from outside sources was restricted to the people working in IT unit based on their job titles such as CIO, CTO, CDO, IT director, IT manager or equivalent. For the chosen contacts, key details of their organization were checked to confirm that they fit to the sample. Amount of personnel, latest revenue and countries of operation were reviewed. These were confirmed from the open sources such as organization websites or published key figures.

Cover letter was drafted to be sent out with a link to the survey and it included survey background, guidance and set expectations towards the respondents. The cover letter is represented in Appendix C. The first invitation for survey was sent out in the beginning of the first week of September when there was over three weeks until the deadline. This

resulted in only couple responses and therefore it was decided to send personalized emails concentrating on why the responses were needed. These kinds of emails were sent as follow-ups during the next two weeks to the potential respondents before the deadline.

After the deadline the data was retrieved from Survey Monkey to an Excel-file. There were different file formats that could be chosen. Xlsx-file was chosen as it was seen as convenient. The gathered data contained all answers that had been given including the unfinished responses, feedback and possible contact details. As the data had been collected next step was to analyze data.

6.2 Data analysis

Before analysis the data was prepared by formatting, coding and cleaning it. As the sample size was quite small it was decided to use mainly Excel for the analysis and visualizations. First the structure of the file containing the survey data was modified as the original format of the retrieval from Survey Monkey was not ready for analysis.

Responses of the scale questions were distributed into six different columns where all columns represented the individual response choices. For these questions respondent could only choose one response. This kind of data was modified into format where all responses per question were located in one column and each line represented one response. For category questions it varied how many choices respondent could select when answering to the questions. For the questions where only one selection could be done the formatting followed the scale questions. However, for those questions where respondent could choose up to all choices the formatting was simpler and required only some modifications to the column headlines.

For all scale questions the range was set for 1-5 in addition to the don’t know option. Based on this the numerical values from 0 to 5 were given for the responses based on their scales. Category questions were coded in a way which indicates if the respondent has or has not mentioned or chosen a category. This means that if respondent had chosen the category its value was set to 1 and if the category was not chosen the value was left blank. Numerical values were also given for the response choice “other”. However, the specifications were left to their original format.

There were five responses that were not finalized. They contained only answers to the first 1-3 questions from the total 26 main questions and therefore they were left out from the analysis. To be able to analyze the data in anonymous format, the last five questions were left out from the analysis files. Some cleaning was done for couple of responses

from background and adoption state questions. This applied to cases where a response was set as other and specifications were given. Based on the specifications, it was possible to place the responses into the given categories. Also, some typing errors were fixed when needed.

As part of the first steps frequencies of the responses were determined for all of the questions and their response choices. This means that individual tables were created for all questions. These tables contained response choices, number of responses per item and their proportion of the responses in total. Modes and medians were calculated for all scale questions with Excel functions. It must be noted that even though “do not know” answers were taken into account in the frequencies, they were not included in for the others such as they can be seen as missing values. Simple bar and column charts were created to visualize the frequencies as they represented well the distribution of the respondent point of views. For the question 26 it was decided to create a graph where it would be possible to compare all of the determinants and their values together. Therefore, vertical and stacked bar was chosen.

Based on literature it was foreseen that analyzing relationships from this kind of small sample would unlikely lead into valuable results. In cloud adoption determinant studies this kind of analyzes were common. Therefore, it was decided that insignificance of results should be still verified with SPSS and coefficient correlations. For this data for questions were uploaded to the tool and the tests were run for questions 3 and 7-24 on cloud adoption, and 26 on success determinants separately. Based on the correlation results the estimations were confirmed, and it was decided that the relationship analysis would not achieve the value as it could with larger samples. Therefore, it was decided that exploratory and descriptive analysis would be the basis for the results and conclusions of this thesis.

7. RESULTS

Target of the results is to represent the main findings from the analysis of the gathered survey data. The findings are covered in the same order as in the questionnaire in appendix C. It is important to note that the data was analyzed anonymously. Therefore, it cannot be confirmed if the 32 respondents are from 32 different organizations and that it must be understood that the responses represent only a small sample of large Finnish organizations. The complete results are available in appendix D.

7.1 Cloud adoption in Finnish organizations

First section of the questionnaire concentrated on background information and cloud adoption status in the organizations. In this section the survey results on that section are gone through.

Questions 1 and 2: Background information

Organizations of the respondents represented nine different industries. The most frequently mentioned industries were manufacturing with 10 respondents, information and communication with 6 and financial and insurance activities with 4. These results are represented in the figure 7 below.

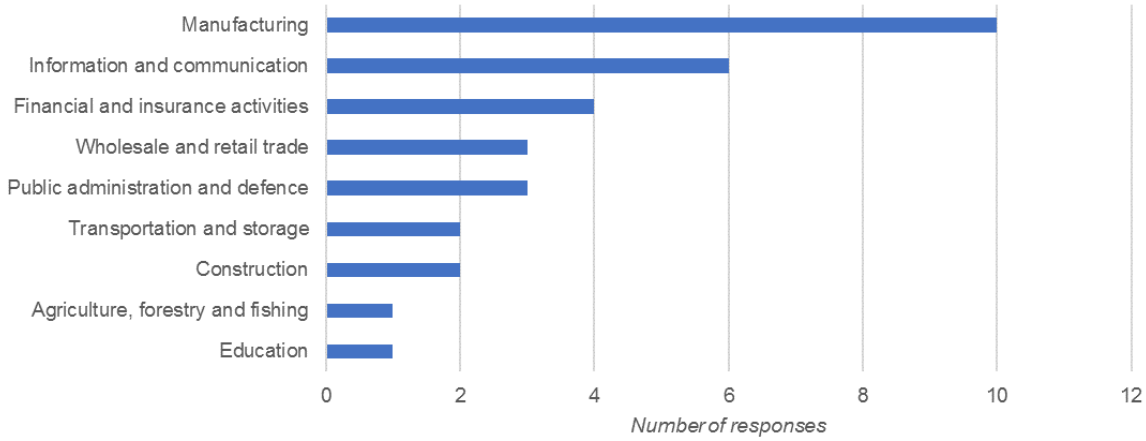

Figure 7. *The industries of respondents' organizations*

As seen in the picture all other chosen categories gathered more than one representative other than agriculture, forestry and fishing, and education. Overall 9 out of 15 industries were represented by the respondents. Based on question two responses almost all respondents represented information technology department as 30 out of 32 selected the

category. The two left represented administration and IoT. This indicates that the respondents were likely to fit into the targeted group.

Question 3: Cloud adoption state in organizations

Based on the results from question number three 30 organizations out of 32 had cloud services already in use. This represents 94 % of all responses. One respondent addressed that their organization has intention to adopt cloud services. In addition, a respondent selected that their organization is assessing the intention to adopt cloud services at the moment. The organization's that were at the moment assessing or had intention to adopt cloud services belonged to industries public administration and defence, and education.

Question 4: Familiar cloud service providers

There are various cloud service providers in the market with various products from infrastructure to software. Based on respondents the most familiar providers were Microsoft, Google, Amazon, Salesforce and SAP. The results are visible in the picture 8.

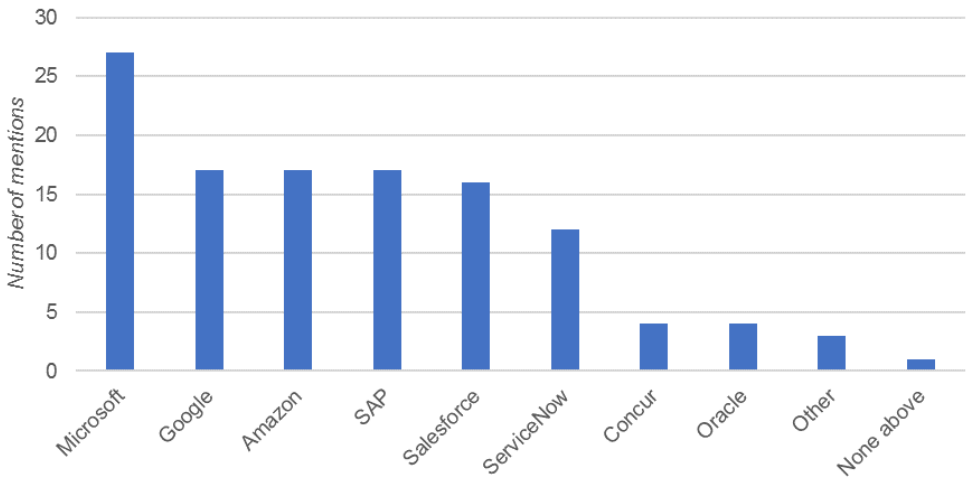

Figure 8. *Familiarity of cloud providers by number of mentions*

The most mentioned five providers gained more than fifteen mentions each. Microsoft stood out from the other providers with 27 mentions. Google, Amazon and SAP gained all 17 mentions and Salesforce 16. As seen in the picture all providers received mentions.

Question 5: Processes already moved to cloud

It was expected that different organizations may move to cloud with different paces, processes and sequences. The question five was related to the processes that had already been taken to cloud and it was shown only to those whose organization had cloud services already in use. Collaboration, human resources and customer relationship management were mentioned the most frequently from the eleven categories. 23 out of 30

respondents selected collaboration, 20 human resources and 19 customer relationship management. All results are represented in picture 9.

Figure 9. *Processes that had been moved to cloud per respondent's organization*

Six categories gathered over 10 mentions. In addition to the already mentioned ones reporting and planning, sales and marketing were included into this group. All categories received at least seven mentions from the respondents. Based on the results respondents could be divided into four categories based on the amount of chosen process categories described in picture 10.

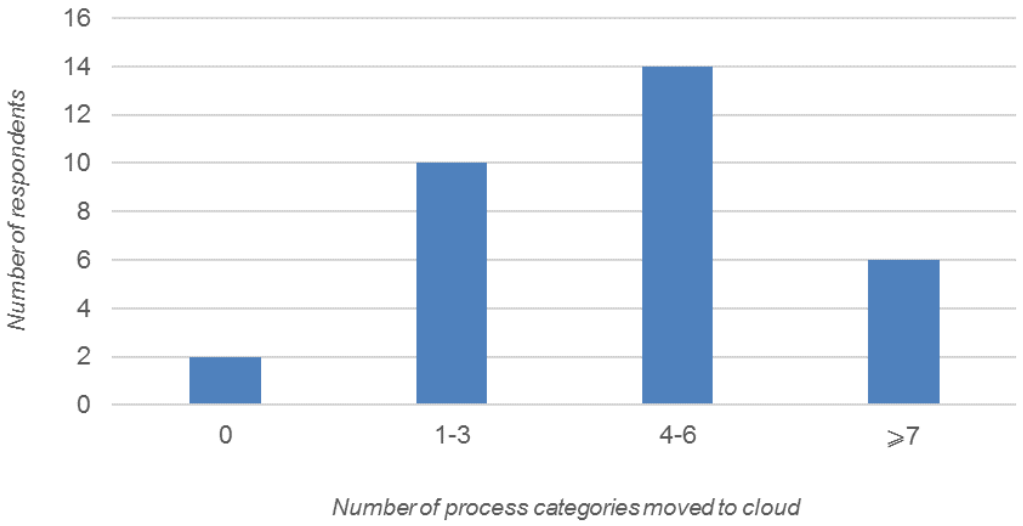

Figure 10. *Categorization of respondents based on the processes moved to cloud*

As seen in the picture two participants did not answer the question as their organization had not moved to cloud yet. 63 % of respondent's organizations had already moved more than three kinds of processed to cloud. 19 % of organizations had moved 7 or more.

Question 6: Processes to be moved to cloud following 1-3 years

The respondents were also asked to evaluate the future movement to cloud. The question number six was shown to all respondents. The top six categories received at least nine mentions. They were enterprise resource planning with 13 mentions, marketing with 10, human resources with 10, billing and invoicing with 10, customer relationship management with 9, and reporting and planning with 9. All values are shown in the figure 11.

Figure 11. *Categories for processes that will be moved to cloud following 1-3 years*

As seen all categories received at least seven mentions. “Other” was selected nine times and specifications were given. From these responses it should be noted that for three respondents the future plans for cloud adoption were unknown or unclear. In addition, two of the respondents specified that they are fully in cloud at the moment and one of them also included that all future systems will be built in cloud.

7.2 Cloud adoption determinants

The second section covered the determinants related to cloud adoption. Different kinds of items from different contexts affect the organizations’ intention to adopt cloud services. Benefits and suitability of the services, organization’s readiness, support from within and pressure outside of organization all have been found to be determinants of cloud adoption in literature. Respondents were requested to assess the statements related to these determinants from their and their organization’s point of view.

Questions 7-11: Relative advantage

Cloud services have been seen to affect agility of business operations for example through flexible cloud-based business processes (Fremdt, Beck and Weber, 2013). 78

% of respondents thought that the effect of cloud services on agility of business operations is either positive or very positive. Others thought that the effect was neutral. Median of the responses was 4 which supports that over half of the respondents thought that the effect is at least positive.

It has been also seen that cloud-based business processes enable organizations to react more quickly to changes caused by changing environments (Fremdt, Beck and Weber, 2013). 75 % of respondents thought that the effect of cloud services on organization's ability to react more quickly to changes is either positive or very positive. Others thought that the effect was neutral. Median of the responses was 4 which supports that over half of the respondents thought that the effect is at least positive.

Information systems affect operational productivity when they are widely used in organizations (Oliveira and Martins, 2011). Cloud services 75 % of respondents thought that the effect of cloud services on productivity of operations is positive or very positive. Others thought that the effect was neutral in addition to one negative response. Median of the responses was 4 which supports that over half of the respondents thought that the effect is at least positive.

Cloud services are seen to provide ease of use through accessibility, simplicity and therefore, better customer and user experience (Gong et al., 2010; Weinman, 2015). 78 % of respondents thought that the effect of cloud services on customer experience is either positive or very positive. Others thought that the effect was neutral. Median of the responses was 4 which supports that over half of the respondents thought that the effect is at least positive.

Effect of cloud services on operational costs can be controversial as based on literature they are seen as cost efficient alternative. However, the level of realized costs may not be easy to predict. 59 % of respondents thought that the effect of cloud services on operational costs is either positive or very positive. 28 % thought that the effect was neutral and 6 % thought it was negative. Median of the responses was 4 which supports that over half of the respondents thought that the effect is at least positive.

Questions 12-13: Compatibility

Intention of cloud services is not to create highly customized solutions to fit into the current processes in the organizations. Therefore, standardization is usually needed for their adoption. 91 % of respondents thought that that cloud service adoption requires changes to be made into the current processes. Median of the responses was 4 which supports that notable number of respondents agreed with the statement.

As with all systems their implementation requires understanding how the existing technologies affect the adoption of cloud services and how they are integrated to the existing technological architecture. It is likely that some kind of changes are needed before the services are up and running. All respondents thought that that cloud service adoption requires changes to organization's technological architecture. Median of the responses was 5 which supports that over half of the respondents strongly agreed with the statement.

Questions 14-16: Ease of use

The intention of cloud services is not to be highly customizable as purpose is to provide more standardized and agile solutions for the customers that are easy to put into operation. The responses were distributed as 31 % of respondents thought that customization of cloud services to fulfill organization needs is easy or very easy. 28 % of respondents thought very difficult or difficult and the major part of respondents remained neutral with their answers. Median of the responses was 3 which supports the distribution of response values.

Ease of use is seen as significant motivator to use and adopt cloud services as it decreases threshold (Gangwar, Date and Ramaswamy, 2015). 72 % of respondents thought that that usage of cloud services is easy or very easy. Rest of them remained neutral with their opinions. Median of the responses was 4 which supports that over half of the respondents thought that the services are easy to use.

Especially public cloud services are seen to be easy to put into operation as they may enable access right after registration. However, it is likely that some more complex enterprise systems need more preparations before they are ready for use. 28 % thought that getting cloud services to operate the way needed is either easy or very easy. 25 % thought that it was difficult or very difficult and the major part of respondents stayed neutral with their answers. Median of the responses was 3 which supports the spreading of values in the scale.

Questions 17-18: Competence and readiness

Capabilities and competencies are needed to be able to drive adoption successfully. If the capabilities are not sufficient, they can be seen as one reason of not moving to cloud. 53 % thought that their organization's capabilities to adopt cloud services were either sufficient or very sufficient. 28 % of respondents thought that the capabilities were not sufficient. Median of the responses was 4 which supports that over half of respondents though that the capabilities are sufficient.

Adoption of new systems require resources such as time, money and personnel. It is likely that the lack of resources can affect the choices related to cloud adoption. 47 % of respondents thought that their organization's resources to adopt cloud services were not sufficient. 25 % thought that they were either sufficient or very sufficient. Median of the responses was 3 which supports the scattering of responses.

Questions 19-20: Top management support

IT decision-making is likely to be done by the management based on the evaluated benefits and risks. Therefore, management's understanding of opportunities could be one of the driving forces for cloud adoption. 44 % thought that their management's understanding for opportunities of cloud adoption were either at sufficient or very sufficient level. 34 % of respondents thought that it was not sufficient. Median of the responses was 3 which supports that the responses were distributed around the neutral value.

Management support is seen to be important as they are the ones that can organize required resources and capabilities for cloud adoption. Also, it is likely that the decision comes from there and their support can be seen as encouraging for others in the organization. In the survey 69 % thought that their management's support was at sufficient or very sufficient level. 13 % of respondents thought that the support was not sufficient, and the rest remained neutral. Median of the responses was 4 which supports that over half of the respondents thought that the support was at least sufficient.

Questions 21-22: Competitive pressure

Drivers of adoption can also come from the outside of organization. Actions of competitors are likely to have effect on the environment where organizations operate in. 40 % of respondents assumed that their competitors had already taken cloud services into use. 13 % thought that their competitors had not done this, and 38 % remained neutral. Median of the responses was 3 which supports the scattering of responses.

There are various benefits that have been connected to cloud adoption. Gaining competitive advantage from the benefits or responding to pressure coming from competitors may affect intentions to move to cloud. 22 % of respondents thought that their competitors were able to react to their customer needs more quickly due to cloud services and 6 % disagreed with the statement. However, half of respondents remained neutral. Median of the responses was 3 which supports the spreading of values in the scale. It must be noted that seven people chose "do not know" and all organizations do not have competitors, and this may have affected the results.

Questions 23-24: Partner pressure

There are other operators in the external environment of the organization in addition to the competitors. Actions of partners may affect the adoption decisions of organizations. 63 % of respondents thought that their organization's business partners had implemented cloud services. 6 % disagreed with the statement and 28 % of respondents remained neutral. Median of the responses was 4 which supports that over half of respondents agreed with the statement.

Ease of collaboration can be achieved through various ways. Cloud services however are seen to provide useful tools for collaboration between partners as it enables the needed integration and flexibility. (Liu et al., 2016) 69 % of respondents thought that cloud services were required for collaboration with their partners. 9 % of respondents disagreed with the statement and 19 % remained neutral. Median of the responses was 4 which supports that over half of respondents agreed with the statement.

Question 25: Cloud adoption challenges

Challenges connected to the cloud services have been well-represented in literature. They vary from technical challenges to ones related to service quality and development. Respondents were requested to select items that they thought to have negative influence on cloud adoption in their organization. Out of 12 predetermined items 11 were selected by respondents as virtual servers were not chosen by anyone. All results are represented in figure 12.

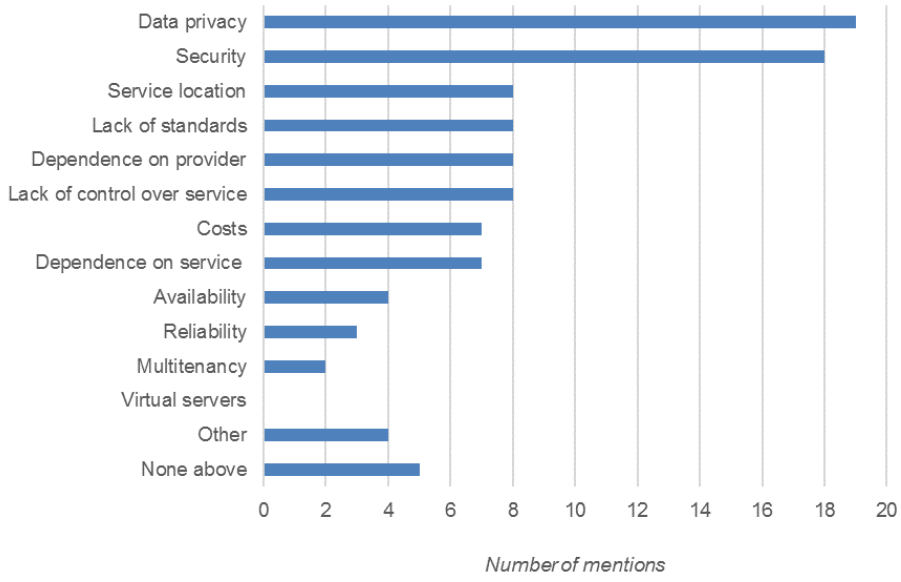

Figure 12. *Items having negative impact on cloud adoption in organizations*

Two items stand out from the results: data privacy and security. Data privacy collected 19 mentions and security 18. Next four items all gathered 8 responses: service location,

lack of standards, dependence on provider and lack of control over service. Other items received 2-7 mentions per item. Surprisingly five respondents expressed that none of the items had negative impact on adoption in their organization. Security and data privacy of cloud services have received a lot of coverage in literature which is in line with the responses.

“Other” was selected by four people who gave specifications for their choice. One respondent mentioned that the licensing models are becoming too tricky and complex when compared to the past. Two others summarized that understanding of infrastructure and lack of cloud professionals in their organization have negative impact. These seem to refer to the level of capabilities and knowledge on cloud services in the organizations. Regulatory parties were mentioned once.

7.3 Success determinants

The third section covered the determinants related to success. Various variables affect the success of the information systems. Respondents were requested to assess the importance of predefined determinants based on their point of view. All results are represented in figure 13.

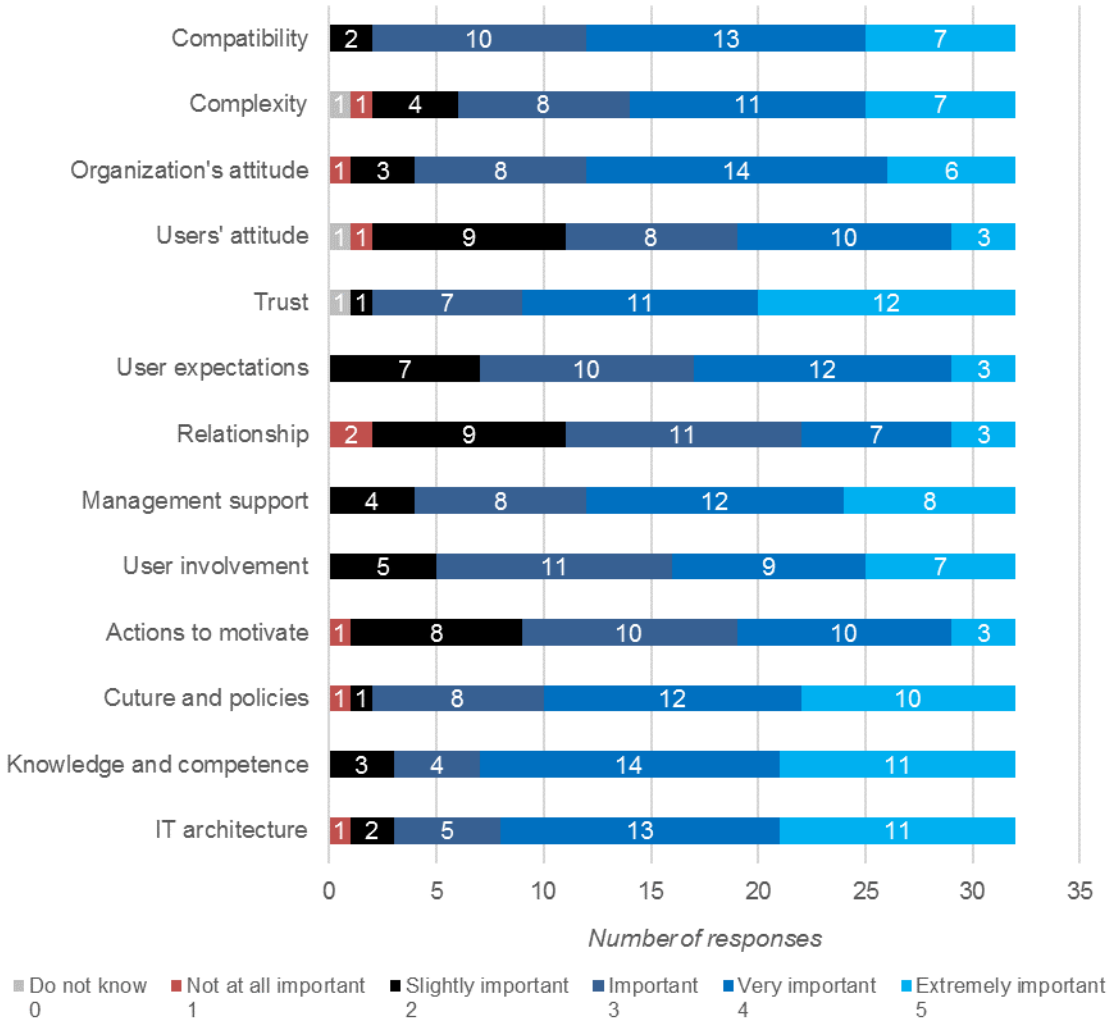

Figure 13. *Assessment of item importance for cloud adoption*

Based on the picture items that were most often referred as very or extremely important were related to organizational competence, IT architecture, trust and culture and policies. Items that were most often referred as not at all important or slightly important were the ones related to user's attitude, user expectations, relationship between developers and users, and actions to motivate.

7.3.1 Task characteristics

When adopting new information systems and for it to succeed it should be analyzed how well it will fit into the organization's existing processes. If they fit well together, compatibility of the combination is good and less changes are required to the existing settings. 63 % of respondents thought that compatibility between organization's processes and cloud services is very or extremely important. Median for the responses was 4 which supports that over half of respondents thought that the item was at least very important.

If the target is that the processes and tasks that will be moved to cloud should be left untouched, it requires analysis for how complex they are and how complex it would be to move them. 56 % of respondents thought that complexity of processes and tasks moving to cloud is very or extremely important item to consider. Median for the responses was 4 which supports that over half of respondents thought that the item was at least very important.

7.3.2 User and social characteristics

All together attitude towards a new system affects the use and user satisfaction. Use is major part of the success as it describes if the system is used in the desired ways after the adoption. Therefore, it should be assessed if the attitude in the organization is in favor or against the use to begin with. 63 % of respondents thought that organization's attitude towards cloud services is very or extremely important when it comes to the success of the adoption. Median for the responses was 4 which supports that over half of respondents thought that the item was at least very important.

If people accept and use system with enjoyment affects the success in the long run. If people enjoy using the system or have positive attitude towards a system, they tend to keep using it and realizing the benefits that have been set towards it. 41 % of respondents thought that users' attitudes towards the use of cloud services is very or extremely important. However, 31 % thought that it was at maximum slightly important. Median for the responses was 3 which supports the spreading of values in the scale.

Service providers are for the most part responsible for the seamless running of cloud services and that the expectations are met. Customers need to be able to trust that the service proceeds in the same level that it has been set together based on the expectations and agreements. 72 % of respondents thought that organization's trust in cloud services is very or extremely important. Median for the responses was 4 which supports that over half of respondents thought that the item was at least very important.

User expectations towards systems affect the usage. Therefore, the consideration of the expectations and their management have impact on the success of the system. 47 % of respondents thought that consideration of user expectations is very or extremely important. The rest thought it was at maximum important or only slightly important. Median for the responses was 4 which supports that over half of respondents thought that the item was at least very important.

7.3.3 Project and organizational characteristics

Relationship between the users and people working with the implementation of new systems or services . Continuous two-way communication and support maintain this relationship and influence on the user satisfaction. 31 % of respondents thought that state of relationship between users and developers is very or extremely important and 34 % thought it was at maximum only slightly important. Median for the responses was 3 which is in line with the scattering responses.

Support from organization's leaders represents the importance of the adoption for the organization. Encouragement and help from the management have effect on the usage and net benefit realization. 63 % of respondents thought that management support for cloud adoption is very or extremely important. Median for the responses was 4 which supports that over half of respondents thought that the item was at least very important.

User involvement is a way to prepare people for upcoming changes and to hear their point of view on the matters related to them. The involvement is seen to affect the usage and user satisfaction towards a system. Half of respondents thought that user involvement in cloud service implementation project is very or extremely important. Median for the responses was 3,5 which supports the even distribution of values for very and extremely important, and slightly important and important.

System usage requires motivation from the users. The motivation can be influenced with extrinsic actions that can be for example rewards. 41 % of respondents thought that actions to motivate employees to use cloud services is very or extremely important and 28 % thought it was at maximum only slightly important. Median for the responses was 3 which supports the scattering of responses.

Culture and policies represent organizational structures that compose the environment which determines for example how well new systems are welcomed to the organizations. Actions to drive these structures affect the usage and net benefits. 69 % of respondents thought that organization's culture and policies are very or extremely important for success of cloud adoption. Median for the responses was 4 which supports that over half of respondents thought that the item was at least very important.

Knowledge and competency about the systems are needed for value creation and also preparing for the changes They affect especially usage but also the adoption decisions. 78 % of respondents thought that organization's knowledge and competence on cloud services are very or extremely important. Median for the responses was 4 which supports that over half of respondents thought that the item was at least very important.

As making any changes to the information systems in an organization, it is important to understand the existing architecture where the changes should be merged into. In addition, it should be analyzed how the architecture impacts on the changes to be implemented and how the changes impact on it. 75 % of respondents thought that organization's IT architecture is very or extremely important when moving to cloud services. Median for the responses was 4 which supports that over half of respondents thought that the item was at least very important.

8. DISCUSSION

Target of this chapter is to discuss about the findings that have emerged based on the examined literature and results of the survey. Purpose of this is to provide the answers to the defined research questions to fulfill the objectives of the thesis. When literature is mentioned in this chapter it refers to the materials used in literature review in chapters 2, 3 and 4, and survey mentions are related to the results presented in chapter 7.

8.1 Status of cloud adoption in large organizations in Finland

Based on the survey results movement to cloud has been surprisingly extensive as 94 % of respondents mentioned that their organization had adopted cloud services. In a report from Statistics Finland it was estimated that 88 % of firms with over 100 employees use cloud services that are subject to a charge in Finland (Tietotekniikan käyttö yrityksissä, 2018). This means that the status based on the survey cannot be far from the current cloud adoption state in Finnish large private organizations. Also, during 2018 Finland was stated to be the leading country of European Union in cloud adoption (*Cloud computing - statistics on the use by enterprises*, 2018). This supports the view of progressing cloud adoption. However, the extensiveness of the sample size should be considered for results validity and how wide they can be generalized.

It must be noted that the adoption percentage varies between industries based on the Finnish metrics. For example cloud services are the most commonly used in information and communication industry and rarely in wholesale. (Tietotekniikan käyttö yrityksissä, 2018) However, it should be taken into consideration that it has been studied that industries do not to have a significant influence on the cloud adoption intentions (Hsu and Lin, 2016). Industry variable can nevertheless affect adoption indirectly by influencing the determinants (Oliveira, Thomas and Espadanal, 2014). Therefore, it seems that these kinds of results are mixed, and the results of the survey are not able to guide into either direction.

Metrics that are available do not tend to consider public organizations cloud services. However, for example Finnish Ministry of Finance has declared that public administration organizations should primarily choose cloud services over on-premise systems when there are no barriers against their adoption and they seem to be more beneficial (Julkisen hallinnon pilvipalvelulinjaukset, 2018). In the survey two out of four public sector organizations had cloud services already in use and the other two organizations were either

going to adopt them or were assessing the adoption. This may indicate that cloud adoption has not progressed the same speed as in private sector. It is still seen that cloud services are positively welcomed in public sector but there are some environmental factors slowing down the adoption (Polyviou and Pouloudi, 2015).

Even though adopter categories in diffusion of innovation theory are mainly used to examine adoption of individuals or groups, it can be assessed where the surveyed organizations are in terms of adopter categories. Based on the survey results there were five respondents that did not see the listed challenges to affect cloud adoption negatively. In addition to these there were also one organization that had moved their processes entirely to cloud. These six people and their organizations could be placed into category of early adopters for their openness and extent of adoption. The proportion of this group does not differ significantly from theoretical foundation which supports the categorization.

In addition, two organizations emerged from the majority. There was an organization that was assessing the adoption and another one that had decided to move to cloud. Therefore, when considering this group of organizations, it is assessed that they should be included to the laggards. However, it must be taken into account that as there is not much information about the status of cloud adoption in Finnish public sector in a different context the categorization could differ. It is likely that the rest of the surveyed organizations – the majority – are part of the early and late majority groups. From the gathered data it is hard to make distinction between these groups and it would require more research to determinate the division.

Based on the survey results the most common processes moved to cloud were related to collaboration, human resources (HR), customer relationship management (CRM), reporting and planning, sales and marketing. This is in line with the report from Statistics Finland where collaboration and customer relationship management were included into the group of most common cloud services that were used by the firms (Tietotekniikan käyttö yrityksissä, 2018). The survey indicates that the adoption of cloud for these organizations has not been restricted only for example to email services as business-related processes had been moved to cloud.

Survey indicates that in the future the attention will shift to enterprise resource planning (ERP), billing and invoicing, marketing, HR, CRM, reporting and planning. Especially increase in number of respondents mentioning ERP for the future catches the attention. This could be related for example to the fact that SAP has promised to support its old on-premise ERP systems just until 2025 which is approaching (*SAP Committed to Innovation and Choice for SAP Business Suite Applications*, 2014). These findings are

quite in line with literature as it is seen as common way to start the adoption from ERP and CRM processes for collaborative initiations that create value (Gutierrez, Boukrami and Lumsden, 2015).

8.2 Factors affecting cloud adoption

Based on literature various factors and their effect on cloud adoption has been studied. Relative advantage, compatibility, ease of use, management support, readiness and competence, customer pressure and partner pressure were chosen for closer examination. The survey results led to observations which will be highlighted in the next section.

Relative advantage

Relative advantage refers to the benefits that technologies such as cloud services can bring to organization. Respondents thought that cloud services had positive effect on various items such as business agility, ability to react, productivity and user experience which was in line with the literature. Only the influence on costs received negative votes in the survey. This may be related to literary stating that it is difficult to predict costs and that switching costs can be relatively high for cloud adoption.

In literature most of the results indicate that relative advantage has positive and driving effect on cloud adoption and the results of the survey are in line with it. Literature indicates that positive view for relative advantage drives organizations to adopt cloud services more quickly (Hsu and Lin, 2016). Couple contradicting studies have found that the effect of relative advantage is insignificant or negative (Low, Chen and Wu, 2011; Lin and Chen, 2012; Gutierrez, Boukrami and Lumsden, 2015). The negative effect had been explained to derive from the risks exceeding the benefits or from the knowledge on risks being more thorough than on the benefits (Low, Chen and Wu, 2011; Lin and Chen, 2012). Still the most studies emphasize the positive effect.

Overall the representativeness of positive responses suggests that benefits of cloud services are widely known in the organizations. Knowledge on relative advantages is seen as motivator for adoption or its expansion (Wang, Wang and Yang, 2010; Low, Chen and Wu, 2011; Hsu and Lin, 2016; Hwang, Huang and Yang, 2016). This suggests that cloud services have become familiar to the organizations and the benefits more recognizable (Hsu, Ray and Li-Hsieh, 2014; Oliveira, Thomas and Espadanal, 2014). As most of the organizations had already implemented adoption, it is likely based on the literature that their knowledge on the effects and benefits of cloud services has driven the adoption.

Compatibility

Based on the survey most of the respondents thought that adoption of cloud services requires changes to be done to the existing processes and IT architecture. This is likely to mean that the services are not automatically compatible to the organizations' existing settings which leads to the requirement of changes. It must be noted that most of the surveyed organizations had cloud services already in use. This is likely to indicate that compatibility of the services is not seen as challenge that cannot be overcome and that respondents know that the adoption of cloud services leads to changes.

Based on literary adoption of new technologies inevitably affect people, processes and structures in the organizations. It is important to understand what kinds of changes are needed to the processes and architectures to achieve desired level of compatibility in organizations (Gangwar, Date and Ramaswamy, 2015). The views on the effect of compatibility in literature vary (Oliveira, Thomas and Espadanal, 2014). Some studies have found it to be insignificant (Low, Chen and Wu, 2011; Gutierrez, Boukrami and Lumsden, 2015; Hsu and Lin, 2016). Others have seen it as significant (Gangwar, Date and Ramaswamy, 2015).

It has been studied that high compatibility between the existing set up and the new cloud services tend to positively influence adoption decisions as it eases the transition and minimizes the need of changes (Gangwar, Date and Ramaswamy, 2015). However, lack of compatibility between cloud services and existing IT does not prevent organizations from adopting cloud services (Phaphoom et al., 2015). Some adjustments are then needed for example to technologies and processes (Espadanal and Oliveira, 2012).

Survey results seem to be more in line with the research that indicates that compatibility is not a driving force of adoption, but it is not its barrier neither. This kind of view is explained with some organizations being willing to try and adopt new solutions and services even if they are not compatible with the existing set up (Hsu and Lin, 2016). If lack of compatibility is not seen as a barrier by the organizations, it may indicate that they are looking for new opportunities and changes to be done to the current situation. However, compatibility of cloud services can be a challenge for organizations that have complex and highly customized internal systems (Gangwar, Date and Ramaswamy, 2015).

Ease of use and complexity

Complexity and ease of use take a stand on the usability and understandability of cloud services. The survey results indicated that cloud services are fairly easy to use. This part is in line with literature as in general cloud services are not perceived as complex technologies which is a driver for their adoption (Gupta, Seetharaman and Raj, 2013;

Oliveira, Thomas and Espadanal, 2014; Hwang, Huang and Yang, 2016; Palos-Sanchez, Arenas-Marquez and Aguayo-Camacho, 2017). This means that the effort that is needed to use the services is not high which is likely lower the threshold to move to cloud.

Just like the results of the survey the views on ease of use and complexity vary (Oliveira, Thomas and Espadanal, 2014). In literature complexity has been found to be also insignificant or barrier for adoption (Low, Chen and Wu, 2011; Gutierrez, Boukrami and Lumsden, 2015; Hsu and Lin, 2016). The insignificance has been explained with immaturity of the technology or that the difference to web-based applications from the user point of view is not significant (Low, Chen and Wu, 2011; Hsu and Lin, 2016). The negative effect derives from the fear of moving from complex legacy systems to more simple cloud services (Gutierrez, Boukrami and Lumsden, 2015). These views are more in line with the survey results on customizability and taking cloud services into use that indicate that they are not straight forward. This means that the views on these matters do not express notably neither difficultness nor easiness.

Literary indicates that the intention of cloud services is to provide more standardized solutions that can be taken quickly into use on demand. Based on literary restricted customizability is likely to be related the customer's decreased control over system and that the services are shared between multiple different customers. This means that the cloud services are not intended to be highly customizable and therefore it is not supposed to be considered as easy.

Survey views on difficulties related to taking cloud services into use is conflicted with one of the basic characteristics of cloud: on-demand self-service. It is likely that this derives from the organizational setting and the technologies that they have in use when moving to cloud. This could be related to compatibility when the information systems are highly customized or complex. Even though complexity of cloud services is not seen as a barrier the adoption still requires effort (Lin and Chen, 2012).

Competence and readiness

Results of the survey indicate that the level of capabilities for cloud adoption is sufficient in most of the organizations, but the state of resources may not be always enough. This refers to that there are likely to be people in the organizations whose capabilities fulfill the requirements related to cloud adoption, but it is the lack of resources that may affect the adoption. Necessary resources and competences enable better support for cloud adoption and it is likely that they drive the adoption forwards (Oliveira, Thomas and Espadanal, 2014; Gangwar, Date and Ramaswamy, 2015).

In literature the readiness and competence of the organization have found to be mainly significant (Low, Chen and Wu, 2011; Espadanal and Oliveira, 2012; Lin and Chen, 2012; Hsu, Ray and Li-Hsieh, 2014; Gangwar, Date and Ramaswamy, 2015; Gutierrez, Boukrami and Lumsden, 2015). This has been explained with capabilities leading to keeping up with the progress of the information technology and being more familiar with new technologies (Lin and Chen, 2012; Hsu, Ray and Li-Hsieh, 2014). Also based on literary competencies and readiness for adoption are related to being able to set realistic expectations. When they are at sufficient level it is easier to assess the possible challenges and requirements connected to the adoption.

As most of the surveyed organizations had already moved to cloud it is unlikely that lack of resources acted as major inhibitor of cloud adoption. However, it is possible that it can slow it down. Also, competences do not always have significant affect especially if the firms have already adopted cloud services. It is possible that they only affect the extent of adoption. (Low, Chen and Wu, 2011)

Management support

Results of the survey indicate that the management's support towards cloud adoption is mainly at sufficient level even though it does not apply to all. In literature significance of top management support for cloud adoption is quite divided even inside a research. Some studies highlight the significance (Espadanal and Oliveira, 2012; Oliveira, Thomas and Espadanal, 2014; Gangwar, Date and Ramaswamy, 2015). Others see management support to be insignificant (Oliveira, Thomas and Espadanal, 2014; Gutierrez, Boukrami and Lumsden, 2015). In general, literary sees management support to affect both the adoption decision and successful adoption.

Based on literature the support is seen as beneficial for the success of adoption which existence can therefore affect adoption intentions. This refers to that the support is seen to be one of the driving forces of the adoption and the success. For example benefit realization depends on enabling the availability of required resources and capabilities (Wang, Wang and Yang, 2010). This is contradicting with the state of resources in the organizations based on the survey results. This may mean that the support of the management is shown more in other actions such as supportive communication than in allocation of resources.

Management's understanding of the cloud service advantages was not well-supported as the opinions in the survey were quite distributed. This is likely to indicate that even though the management is supportive towards the adoption of cloud the knowledge on

benefits could be improved. In literature management's understanding of the cloud adoption importance affects the organizational acceptance which is crucial for adoption and the lack of it acts the opposite way (Espadanal and Oliveira, 2012). Therefore, understanding of opportunities supports management of organizational structures and policies which affect the organizational environment. It also enables managers to realize the role of technology and assess the requirements for its progress. (Gangwar, Date and Ramaswamy, 2015).

Based on the survey most of the organizations had adopted cloud services. When management support is assessed as a whole it seems that the results are in line with the studies that see support as mixed however still more significant than not as the support has not been mainly insufficient. Support in literature is seen as a driving force for cloud adoption but the lack of it can be a barrier (Espadanal and Oliveira, 2012). One explanation for it that has been given is that support from management provides the needed resources and engagement which favors the adoption (Oliveira, Thomas and Espadanal, 2014). The insignificance has been explained with growing awareness for cloud services, unrecognized value, lack of standards and risks (Wang, Wang and Yang, 2010; Oliveira, Thomas and Espadanal, 2014; Gutierrez, Boukrami and Lumsden, 2015).

Competitive pressure

Based on the survey results competitive pressure acting as a driver of adoption did not receive support from the respondents. As four organizations belonged to public sector, the questions were unlikely to be applicable to them. The rest of the neutral answers may refer to organizations not following closely their competitors' advances in cloud or information technology. This is not in line with some of the literature as the pressure is seen to be significant determinant of cloud adoption and speed it up if organizations experience demanding competition in their field (Zhu et al., 2006; Low, Chen and Wu, 2011; Gangwar, Date and Ramaswamy, 2015; Hsu and Lin, 2016)

The significance has been explained by firms seeing the potential of cloud adoption that enables them to respond more quickly to changes (Low, Chen and Wu, 2011). It is seen that the pressure of competitor adopting new technologies has direct effect on organization's desire to move along to maintain their position in the environment (Gangwar, Date and Ramaswamy, 2015). It must be noted that the driving force of competitive pressure is not always seen as positive as it may lead to organizations moving to cloud but not concentrating on the adoption and integration of the technology to the organization (Zhu et al., 2006; Gangwar, Date and Ramaswamy, 2015).

The survey's results are however supported in some articles. The insignificance of competitive pressure has been reasoned with that even though advantages of cloud services are known in the organizations, translating them into competitive advantage has not yet been accomplished (Oliveira, Thomas and Espadanal, 2014). This is in line with the relative advantage results as benefits seem to be well-known organizations. However, it seems based on the results that the questions related to competitive pressure as a whole may not have been the most suitable ones to measure the views of the respondents.

Partner pressure

Results of the survey suggest that partner pressure is likely to have affected adoption in the organizations. It was seen that many partners had already adopted cloud services and more often than not they are seen as a requirement for collaboration. It seems that the respondents were well-aware of their partner's adoption and that it is though that cloud services provide valuable basis for collaboration with the partners. When compared to the survey results literature is not constantly highlighting the partner pressure significance. However, there are some studies that indicate its positive effect on cloud adoption (Low, Chen and Wu, 2011; Gangwar, Date and Ramaswamy, 2015).

Partnerships and enhancing cooperation to fulfill customer needs are indeed seen as external drivers of cloud adoption (Gangwar, Date and Ramaswamy, 2015). This is explained with some organizations having pressure to act according to their partners' wishes or that they benefit from the cooperation (Low, Chen and Wu, 2011)l. Referring to the literature pressuring actions can be either persuasive or compelling. This means that the pressure experienced by organizations and their format can vary. It is therefore likely that some of the organizations in the survey have experienced that the collaboration with partners is a valid reason for cloud adoption or extension of it.

Challenges

Even though many of the organizations taking part in the survey had already adopted cloud services various items were seen to have negative impact on the adoption. During 2014 three factors were seen as the most restricting ones for the use of cloud services: security, costs and lack of knowledge (Tietotekniikan käyttö yrityksissä, 2014). Most highlighted ones in the survey in order were data privacy, security, service location, lack of standards, dependence on service provider and lack of control over service. Both results indicate security to be one of the main challenges.

Data privacy and security were the most highlighted items having negative influence on cloud adoption in the survey. They also have been found to be major concerns for people in literary. It is likely that this is connected to the control over services being transferred

to the provider who must guarantee that the security measures are in place and data privacy can be respected. These kinds of dealings must require trust from the customers and assurances from the providers.

Security has also been found to influence cloud adoption decision-making even though it has not been widely highlighted in literature concentrating on DOI theory and TOE framework (Gupta, Seetharaman and Raj, 2013; Hsu and Lin, 2016). This is in line with the survey results as major part of respondents admitted that it has negative impact for the adoption in their organizations. Security issues may be the determinant for organizations to choose private cloud services instead of public ones (El-Gazzar, Hustad and Olsen, 2016).

Based on Tietotekniikan käyttö yrityksissä (2014) report security has been experienced by organizations for years as a major challenge for cloud adoption. The attention for data privacy and security may be also related to GDPR compliancy. Due to the General Data Protection Regulation organizations must secure the privacy of personal data as they are responsible for the stored data even though they are acquiring the services from a third party (Guidelines on the use of cloud computing services, 2018). This may create additional pressure for organizations to consider the security of cloud services.

Service location was also seen in survey to be one of the characteristics to have negative affect on cloud adoption. Usually regulations that affect cloud providers are determined based on the location of the data centers and data (Brender and Markov, 2013; Dutta, Peng and Choudhury, 2013; Gutierrez, Boukrami and Lumsden, 2015; Phaphoom et al., 2015; El-Gazzar, Hustad and Olsen, 2016). In the literary it was also highlighted that customers do not have exact knowledge about the resource locations. This may complicate service acquirement further.

Lack of standards received attention in the survey. This indicates that there is still issues with the extent of existing standards and their implementation by cloud providers even after years of progress. Based on literature existence of standards and their implementation would advance interoperability of cloud services, ease their implementation and prevent vendor lock-in. Lack of standards has been viewed as barrier of cloud adoption in the literature.

Dependence on provider and lack of control over service were viewed to have negative impact on the adoption intentions by the survey participants. It is likely that these two are connected as lack of control over service results in customer having to rely on provider. This means that when the organizations cannot manage everything in the cloud services

themselves, they must rely on the providers to do their part. Based on literature quality and availability of service in addition to the security depend on the provider's actions.

8.3 Factors affecting successful cloud adoption

Organizational competence, IT architecture, trust, and culture and policies were highlighted in the survey results. Other factors were related to project and organizational characteristics and trust to user and social. This may refer to respondents seeing more value in the factors that are more related to organization or the implementation itself than to the individuals or tasks.

Organizational competence

Organizational competence was the most valued item from the factors in the survey. Based on literature it is connected to the management's knowledge on business, information technologies and their alignment. The valuation is not surprise as succeeding can be closely related to the skills and knowledge at hand in an organization. Therefore, knowledge is likely to guide many of the decisions related to adoption and its progress.

This is in line with literary indicating that the knowledge and experience enable prediction and assessment of possible challenges and requirements related to service implementation. Also, the competence helps to prepare for them which is likely to support successful implementation. Competence therefore enables to view the adoption from systematical point of view and to apply experiences. Based on literary organizational knowledge influences both the adoption intention and usage of the systems after its implementation. It is therefore likely that knowledge helps in making more informed decisions for suitable solutions that fulfill the requirements that have been set. This is in line with literature which indicates that the capabilities and knowledge on cloud enable to better realize the value from adoption (Garrison, Wakefield and Kim, 2015).

IT architecture

State of organization's information technologies as a whole was set as the second most valued one in the survey. This item is the most technical from all the determinants of success. It also seems to be the most objective one as it describes the current state of the organization's technologies instead of the views of organization and its individuals. Based on literary implementation of new technology or development of old ones affect the existing group of technologies. They also have influence on the technologies to be implemented.

Survey results also brought up that adopting cloud services requires changes to the existing architecture of organizations. Combination of these results indicate that current information technologies of the firm need to be taken into consideration both in decision-making and adoption. It is related to being likely that the IT architecture determines what kind of changes are required to do in addition to the implementation of the cloud services.

Based on literary state of information technologies affects information quality, use and organizational net benefits. It is therefore a factor that has wide influence on the outcome of the adoption. These thoughts are in line with literature that indicates that the technologies and capabilities related to them determine how flexible and agile foundation organization has for the integration of cloud services. It is likely to affect the choice for deployment model and also the dependence on the provider. (Garrison, Wakefield and Kim, 2015)

Trust

Trust was defined to be the third most important success determinant in the survey. Based on literary it describes the state of beliefs towards services. That way it differentiates from the other factors by being tied to more personal views. Trust for cloud services is related to control over service, ownership of data, violating trust and security (Khan and Malluhi, 2010). It therefore can be seen as complex determinant related to important topics.

Based on literary about cloud services, large part of control over the service belongs to the provider. Therefore, it is comprehensible that trust was determined to be one of the most important determinants. Decreased control over system leads to decrease in trust (Khan and Malluhi, 2010). Literary indicates that trust in the vendor and the service affects the use of the information systems. It is therefore likely that if an organization or its employees do not think that a service is trustworthy, it is not used in a way that it is intended to. These thoughts are in line with research indicating that the trust between vendor and the customer is crucial due to the outsourcing element of cloud services (Venters and Whitley, 2012).

Culture and policies

Coordination mechanisms named culture and policies were set as the fourth most important item out of the success determinants. Based on literary their intention is to reinforce the organizational structures and influence the organizational context which affects the environment where the new services are implemented. This refers to that the mechanisms are likely to guide or determine how changes are welcomed and implemented in organizations.

Based on literary mechanisms are seen to affect system use and realized net benefits. Therefore, they are likely to affect how much effort a successful adoption of services requires in an organization. In a culture that is ready for new ideas and changes, less effort are needed to achieve the targets (Lehman, Greener and Simpson, 2002; Weiner, 2009). Also, the encouragement from management and organizational adaptability drive implementation of changes in organizations. In addition organizational stiffness and change resistance either slow down or prevents the implementation of changes (Lehman, Greener and Simpson, 2002)

The effects of culture and policies are also discussed in cloud adoption literature. It is stated that it needs to be considered how people in organizations perceive the changes that cloud services bring with them. Changes related to tasks, processes and roles can be seen differently by people based on personal views and culture. These aspects also affect how the changes should be managed and introduced to an organization. (El-Gazzar, Hustad and Olsen, 2016) Therefore, the management of the structures can be seen as important part of cloud adoption success which is supported by literature.

Other factors

After these items compatibility, organizational attitude, management support and task complexity where the ones which were valued at moderate level. Literary indicates that they have impact on use, user satisfaction and net benefits on individual and organizational level. In order relationship between developers and users, actions to motivate, user's attitude towards use, user expectations and user involvement were the items that were valued the least in the survey. Based on literary these items have influence on intention to use, use, user satisfaction, system quality in addition to net benefits on individual and organizational level.

It must be noted that based on literature none of the items valued the most affect user satisfaction. It influences the intention to use system and net benefits in addition to the indirect impact on system use. This indicates that user satisfaction is important building block for success which may not be at the center of the attention. Even though the research concentrated on the organizational level adoption and success, individual level cannot be ignored. The IS success model contains the individual and organizational levels for a reason. If something is not done at individual level in an organization, it is likely to be not done at organizational level either. Also, based on literature the success variables are combinations that are affected by various determinants. Therefore, even the items that are tied more into individuals should not be forgotten.

8.4 Analyzing the combination of factors

Based on the research there are connections between the factors affecting cloud adoption and its success. Based on literary the foundations of the items are built on contexts that both contain technology and organization including the structures and the people. They both highlight how different factors from the contexts affect adoption intention and its success. The picture 14 summarizes the highlighted factors based on literature and the survey.

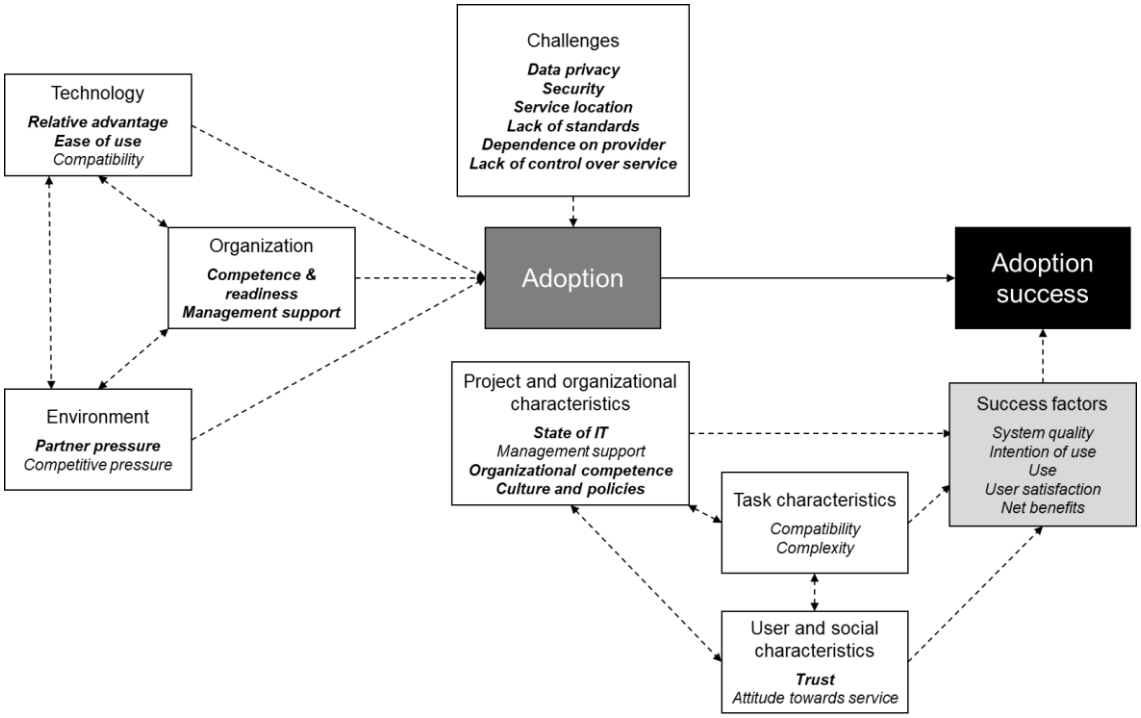

Figure 14. *Factors affecting cloud adoption and its success*

As it is visible in the picture there are implications that can be derived. For example, compatibility, management support, benefits and competence appear in both contexts in one way or another. In addition to these some other connections can be seen in the entity of factors. In literature compatibility is seen as significant factor for adoption and success but the contexts differ slightly. Based on literary compatibility for adoption considers organizations' processes and technologies and for success it is restricted to task related point of view. As mentioned, survey results however did not indicate that compatibility would be a driver of the cloud adoption in organizations and one of the most important factors for success. This tells that the results were not entirely in line with literature.

Management support represents quite the same for both adoption and its success. It is seen in literature as the driving force which purpose is to enable the use of required

resources and engagement of the people in organizations. Based on literature and survey organizations should consider and knowledge its importance for cloud adoption and its success in organizations even more profoundly than today.

For relative advantage both the potential benefits and challenges are considered to assess the suitability of the services. Part of the success factors are the net benefits that describe the realized advantages from the use of the technology. There is therefore a connection between the factors related to adoption and its success as the outcome determines how the expectations have been met. In literature it is stated that target of the cloud service adoption are for example cost savings, agility and improvement in productivity. However, the cloud adoption success and realization of benefits are rarely discussed and analyzed.

Many of the challenges brought up by the respondents can be connected to trust which is part of the factors affecting success. Therefore, it would make sense to trust also influence cloud adoption as it is unlikely that an organization would implement cloud services if they do not trust them. It has indeed been studied that trust affects cloud adoption indirectly (Chen, 2017). It is also interesting that the challenges highlighted in literature and survey seem to be the factors that are related to external elements such as service provider or service itself and not to the organizations themselves. This was not directly discussed in literature.

It is likely that the challenges in addition to the adoption affect the success. The organizations had adopted cloud services regardless of the negative impact of the challenges which indicates that they can be overcome. This may refer to that trust, support and competences can be used to influence the effect of challenges. It has been studied that organizational and IT capabilities have effect on the success of the cloud adoption by being able to plan and male preparations against challenges and mitigating risks (Garrison, Wakefield and Kim, 2015). Therefore, it makes sense that competence is brought up as factor having effect on both adoption and its success.

What has also caught attention is that cloud adoption is seen to require making changes to the processes and technologies in organizations. In literature adoption of technology also affects the organization and its people. Therefore, it is surprising that change management is rarely discussed in cloud adoption literature. It has been mentioned few times, but it has never been the central part of cloud adoption research.

9. CONCLUSIONS

The target of the conclusions is to summarize the study and its main findings. In addition, significance of the study is assessed along with the fulfillment of the research objectives. Also, the limitations of the research are discussed, and the research methodology and decisions are evaluated based on their validity and reliability. At the end potential research subjects are introduced.

9.1 Responding to research questions

The research questions were created based on research motivation and definitions. The target of the thesis was to provide answers to them. Based on the questions, thesis concentrated on clarifying what the status of cloud services adoption is in large Finnish organizations in addition to finding out which factors affect cloud adoption and its success.

Literature sources were used to provide background and theoretical foundation for the study. Empirical studies were utilized to establish what kind of research had been done earlier and what were the findings and implications. Literature was also used to support and guide the design of the survey, its conduction and data analysis. The findings were derived from application of literature sources and survey results.

Question 1: What is the status of cloud adoption in Finnish large organizations?

The first research question referred to clarifying how Finnish large organizations have been progressing with moving to cloud. In order to respond to the question, it was concentrated on where the organizations were with their cloud adoption activity, what kinds of processes had been moved and which will be moved to cloud during the following years. The survey was used to answer these questions.

It seems that the cloud adoption has been moving forward surprisingly fast in Finland based on the survey results which were supported by other sources. 94 % of surveyed organizations had already adopted cloud. Only two organizations that both belonged to public sector did not have cloud services in use. Even though cloud adoption literary indicates that industries do not significantly affect the cloud adoption, based on other sources and survey it is likely that there are differences in adoption between private and public sectors.

Survey results indicated that the cloud adoption in the organizations is not only restricted on independent services such as email or storage as most of the organizations had already moved at least four kinds of business supporting processes to cloud. The most highlighted ones were processes related to collaboration, human resources and customer relationship management. In the processes that are likely to be moved to cloud during next 1-3 years enterprise resource planning, marketing and human resources were mentioned the most.

Question 2: What kinds of factors affect cloud adoption and how?

The second research question referred to finding out which factors influence moving to cloud and how they affect it. In order to respond to the question, literature related to Diffusion of Innovation theory and Technology-Organization-Environment framework were applied to create the survey. Both literature and survey results were used to answer the question.

It was found out that three contexts technology, organization and environment affect the adoption of cloud services. Factors under these contexts have been studied in order to clarify if they are determinants of cloud adoption. Based on literary relative advantage, ease of use and compatibility were chosen for technology context. Readiness and competence, and management support were selected for organization. Competitive and partner pressure were chosen for environment.

Based on the survey organizations have a good knowledge about the benefits of cloud services which is likely to drive their adoption. Views on relative advantage act as motivators for adoption as their sum tends to guide the solution choices. Cloud services are seen to be easy. Also, ease of use and low complexity lower the threshold to try new solutions. People seem to understand that the adoption of cloud services require changes to be made into the processes and IT architectures in organizations. Based on this the high compatibility is unlikely to be a driver of cloud adoption even though it definitely is not seen as a barrier either.

Availability of capabilities and resources for cloud adoption may not be always at sufficient level. Nevertheless, they help in assessment and evaluation of adoption and are likely to support progress of cloud adoption. Even though survey indicated that there may be need for strengthening management support, it is seen as a way to drive adoption. Sufficient support is likely to affect positively on adoption intentions as it is seen as valuable asset for its successful progress. Partner pressure was highlighted as a viable factor for driving cloud adoption. It was stated the cloud services are valid for enhancing collaboration with the partners.

Few factors that were seen to affect adoption of cloud negatively stood out from the group. Data privacy, security, service location, lack of standards, dependence on provider and lack of control over service were highlighted in the survey results. This indicates that the organizations are mainly concerned with trustworthiness of the providers and the either interoperability of the services or the effort of switching. It must be noted that due to the cloud adoption rate these challenges are unlikely to be insurmountable.

Question 3: What kinds of factors affect success of cloud adoption and how?

The third research question referred to understanding which factors influence cloud adoption success and how they affect it. In order to respond to the question, information systems success model was applied to create the survey. Both literature and survey results were used to answer the question.

From the factors that are seen to affect success of the information systems organizational and project characteristics received the most attention. State of the information technology in organization, trust towards cloud services, organizational competence, and culture and policies were considered the most valuable factors based on the survey results. At the same time factors related to the views of the individuals received the least attention.

Existing information technologies determine the extent of changes that are needed when new technologies are adopted. Trust is crucial part of cloud adoption success as decrease in control when moving to cloud services has negative influence on trust. Lack of trust is likely to lead into unused services. Organizational knowledge enables to plan ahead and prepare for challenges. Coordination mechanisms have influence on the environment of the adoption, how changing information technologies accepted and how much effort adoption requires.

9.2 Fulfillment of the research objectives and research significance

The main target of the study was to be able to answer the set research questions related to status of cloud adoption and factors affecting adoption and its success. Estimation on cloud adoption status was defined based on the survey results and evaluated based on supporting materials. It was stated if organizations had already moved to cloud or not, what kinds of processes had been and would be moved to cloud during next few years. It is seen that these will provide sufficient view on cloud adoption at the moment.

Literature review was done to find out what kind of factors would be likely to affect cloud adoption and its success. The views of organization representatives were collected

through a survey on the factors and their importance. It was then estimated what kind of factors were likely to have had effect and how. The results were compared to the literary sources and were estimated to be plausible. Based on these it is evaluated that the targets were fulfilled at sufficient level.

Literature review that was conducted summarized the findings of empirical and theoretical researches on cloud adoption and information success in addition to the factors affecting them. The combination of two themes – cloud adoption and information systems success – enabled highlighting the overarching items. The only publicly available reports in Finland were conducted by Statistics Finland. These reports have been done yearly on the information technology usage in Finnish firms. However, their results were only limited to private sector and during the resent years they have only described the usage of cloud services by industry and type of service which is limited. Therefore, it is seen that this thesis is able to present new information about cloud adoption in large Finnish organizations. However, it must be noted that there are restrictions to the generalizability of the results due to the limited amount of responses.

Status of the cloud adoption enables comparison of progress. Management can evaluate where their organization is with their cloud adoption at the moment when compared to the survey results. Managers can understand what are the factors that are likely to affect the cloud adoption and its success in their organizations. Based on this they can for example influence the success of the adoption via strengthening for example management support or . Even though the organizational factors were more valued based on the survey, other factors related to tasks and users should not be passed as invalid. It should be seen that the success is complex target which is dependent on various different kinds of factors. However, it is good to understand that due to the uniqueness of cloud services may affect the importance of the factors.

9.3 Evaluation and limitations of research

Research evaluation is based on its validity and reliability. Validity describes how well the means and intention of the research fit together. Validity of questionnaire derives from being able to measure or gather information that was targeted. It is the accuracy of collected data. (Saunders, Lewis and Thornhill, 2009, pp. 371–372) It therefore describes how well design and content of the questionnaire support gathering the information that was required. Validity can be divided into internal and external validity. Internal validity refers to the research design supporting drawing valid conclusions from the results and eliminating alternative explanations. External validity refers to the wider generalizability of the results. (de Vaus, 2001, pp. 27–28)

The chosen research methods and decisions that were done seemed to support drawing of the conclusions. The decisions and design were based on literary validated studies. The restricted amount of survey responses limits the generalizability of the results. It must be however noted that Finland quite small country with limited about of large organizations. Therefore, the findings of the thesis can be generalized to some extent.

Validity assessment can be divided further into content, criterion-related and construct validity (de Vaus, 2001, pp. 29–30; Cooper and Schindler, 2008). Content validity describes how well the questions cover the whole concept. Valid coverage can be determined based on literature or discussions. (de Vaus, 2001, p. 30; Saunders, Lewis and Thornhill, 2009, p. 373) Major part of the questions in used in questionnaire were derived from literature. Their content was not touched significantly as the intention was only to clarify them instead of changing their content. The concept coverage of the questions was evaluated based on their use in previous empirical studies and also through the testing of the questionnaire. Otherwise it was seen that the questions covered the factors well.

Criterion-related validity describes how accurate predictions can be done based on the results (Saunders, Lewis and Thornhill, 2009, p. 373). It is seen that the survey was a valid choice for the study as it enabled gathering data from wider audience than it would have been possible. The challenges were derived from the restricted amount of responses which affected the data analysis and comparison of the results. Even though the questions were mainly derived from literature and tested before the survey one item was found to be problematic. When analyzing the survey data question related to competitors achieving competitive advantage from cloud adoption was found to be unsuitable for its purpose. Therefore, the results of this were seen to be invalid for closer examination or deriving implications.

Construct validity describes how well questionnaire measures the subjects it is intended to measure. It can be assessed by evaluation on how well the survey results correspond to the theoretical foundation. (de Vaus, 2001, p. 30; Saunders, Lewis and Thornhill, 2009, p. 383) The survey results are supported by literary. However, it must be considered that even in literary the results for cloud adoption and information success studies are not always consistent. There is therefore not always unanimous views on which of the factors are significant for cloud adoption and its success and which are not. The findings of the thesis seem realistic based on the researches that have been done on the subject.

For a study to be valid it also requires reliability in order to lead into targeted results. Reliability requires the survey questions to be unambiguous to prevent respondent from

understanding the questions wrong and answering based on their wrong assumption. (Saunders, Lewis and Thornhill, 2009, p. 373) These were taken into consideration especially in survey design and testing. Individual questions were assessed and developed to support their clarity and understanding. The questionnaire was tested and evaluated with multiple people to ensure that the questions could be understood only one and consistent way.

Reliability is based on the ability to repeat similar research leading to consistent findings with varying conditions (Saunders, Lewis and Thornhill, 2009, p. 373). In the chapters 4 and 5 the used research methodology was described. Based on the detailed explanation it is realistic that this kind of research can be repeated by following the same steps. However, it must be noted that the amount of responses (32) is restricted and quite small. This can lead into that repetition of the study may not provide identical results. This nevertheless may be more connected to the generalizability of the sample and it must be noted that the results of the thesis were in line with other studies on the subjects. Therefore, it is seen that the reliability of the research is at acceptable level.

Reliability of data is reduced by contamination of answers. This can happen if respondents would modify their answers to be more acceptable from their point of view or through discussion with others about the answers to be given. (Saunders, Lewis and Thornhill, 2009, p. 363) The first choice is not very likely in self-administered questionnaires (Dillman, 2007). It is possible that that when the surveys are self-administered respondents could have discussed their answers with others, but it is unlikely. There is one issue related to a survey data. It cannot be assessed if the data is from 32 different organizations or if there are more than one respondent per organization. It is however estimated that there should not be multiple this kind of situations as distribution was restricted. This means that their effect on the survey results should not be notable. Therefore, it is seen that the reliability of the research is at acceptable level.

9.4 Further research

There are different ways to go with research on this matter. This study is seen to be clarifying only the basis of the cloud adoption in Finnish organizations. It could be beneficial to continue the research on more detailed and practical level.

It is seen that it would be valuable to do further research on cloud adoption success in Finland. In this study it was only considered what kind of factors are seen to be important in organizations. In the future it could be studied what are the views of organizations on the journey to adopt cloud services. In would be beneficial to understand what the biggest

challenges and wins have been for the organizations in addition to what kind of approaches have been taken. It could also be clarified if the determinants from literature match to the views of the organizations on why they have moved to cloud.

Another subject for research would be the extent of cloud service utilization. It would be beneficial to find out if the cloud services that have been taken into use are used in ways they were intended to and how their implementation to the everyday use has been carried out. In addition, if the adoption has not been extensive, it should be clarified why it has been restricted.

It would be interesting to concentrate on public organizations as there seems to be lack of information from that field. Finding out the differences between private and public sector adoption would help to clarify if they indeed are slower in their pace and why. It would also be valuable to understand if the effect of the factors may differ between public and private organizations.

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APPENDIX A: VALIDATIVE INTERVIEW QUESTIONS

Theme 1 : General comments

1. How would you describe the questionnaire in general?

Theme 2: Questionnaire length

2. How would you evaluate the amount of time it took to complete the questionnaire?
3. How would you evaluate the amount of questions?

Theme 3: Guidance

4. How would you describe the guidance of the questionnaire in general?
5. How did you manage to follow the guidance?
6. How would you develop the guidance?

Theme 4: Questions

7. How would you describe the questions in general?
8. How would you comment the formatting and clarity of the questions?
9. Which questions were challenging and why?
10. Did it require large amount of effort to answer the questions?
11. How would you describe the response choice scales used for the questions?
12. Were there challenges to choose only one choice when required?
13. Were there questions that you did not want to answer? If yes, why?
14. How would you develop the questions?

Theme 5: Structure

15. How would you describe the structure of the questionnaire in general?
16. How would you describe the question order in general?
17. How would you describe the place of personalized report questions?
18. How would you develop the structure?

Theme 6: Survey significance

19. How would you describe the significance of the survey results for you?
20. How would you describe the significance of the personalized report for you?

APPENDIX B: QUESTIONNAIRE

Section 1: Background

1. **Question:** Please choose the industry in which your organization operates.
   Optionality: Obligatory
   Type: Multiple choice, one selected
   Options:
   Agriculture, forestry and fishing
   Manufacturing
   Electricity, gas, steam and air conditioning supply
   Water supply, sewerage, waste management and remediation activities
   Construction
   Wholesale and retail trade
   Transportation and storage
   Information and communication
   Financial and insurance activities
   Professional, scientific and technical activities
   Administrative and support service activities
   Public administration and defence
   Education
   Human health and social work activities
   Arts, entertainment and recreation
   Other
2. **Question:** What is your responsibility area in your organization?
   Optionality: Obligatory
   Type: Multiple choice, one selected
   Options:
   Production
   Operations
   Information technology
   Finance
   Human resources
   Sales and marketing
   Purchasing
   Legal
   Administration
   Research and development
   Other

Section 2: Cloud adoption state

3. **Question:** Please assess the state of cloud adoption in your organization
   Optionality: Obligatory
   Type: Multiple choice, one selected
   Options:
   0 = do not know
   1 = Organization has assessed and rejected the intention to adopt cloud services
   2 = Organization has no intention to adopt cloud services
   3 = Organization is assessing the intention to adopt cloud services
   4 = Organization has intention to adopt cloud services
   5 = Organization has cloud services already in use
4. **Question**: Please choose the providers whose cloud services you have experience on.
   Optionality: Obligatory
   Type: Multiple choice, multiple can be selected
   Options:
   Salesforce
   Microsoft

Google
Amazon
Concur
SAP
Oracle
ServiceNow
None above
Other

5. **Question:** Please elaborate which kind of processes have been already moved to cloud in your organization.
   Optionality: Obligatory if 5 was chosen in the question 3, otherwise not shown
   Type: Multiple choice, multiple can be selected
   Options:
   Enterprise resource planning
   Inventory and supply chain management
   Billing and invoicing
   Accounting
   Reporting and planning
   Human resources
   Sales
   Marketing
   Customer relationship management
   Collaboration
   Other

6. **Question:** Please elaborate which kind of processes will be moved to cloud in your organization during the next 1-3 years.
   Optionality: Obligatory if 3,4 or 5 was chosen in the question 3, otherwise not shown
   Type: Multiple choice, multiple can be selected
   Options:
   Enterprise resource planning
   Inventory and supply chain management
   Billing and invoicing
   Accounting
   Reporting and planning
   Human resources
   Sales
   Marketing
   Customer relationship management
   Collaboration
   Other

Section 3: Cloud adoption determinants

Assess the following statements based on your point of view.

Subsection 3.1: Technology

7. **Question:** Cloud services' effect on agility of business operation is:
   Optionality: Obligatory
   Type: Multiple choice, one selected
   Options:
   0 = Do not know
   1 = Very negative
   2 = Negative
   3 = Neutral
   4 = Positive
   5 = Very positive

8. **Question**: Cloud services' effect on organization's ability to react more quickly to changes is:
   Optionality: Obligatory

Type: Multiple choice, one selected
Options:
0 = Do not know
1 = Very negative
2 = Negative
3 = Neutral
4 = Positive
5 = Very positive

9. **Question**: Cloud services' effect on productivity of operations is:
Optionality: Obligatory
Type: Multiple choice, one selected
Options:
0 = Do not know
1 = Very negative
2 = Negative
3 = Neutral
4 = Positive
5 = Very positive

10. **Question:** Cloud services' effect on customer experience is:
Optionality: Obligatory
Type: Multiple choice, one selected
Options:
0 = Do not know
1 = Very negative
2 = Negative
3 = Neutral
4 = Positive
5 = Very positive

11. **Question:** Cloud services' effect on organization's operational costs is:
Optionality: Obligatory
Type: Multiple choice, one selected
Options:
0 = Do not know
1 = Very negative
2 = Negative
3 = Neutral
4 = Positive
5 = Very positive

12. **Question**: Adoption of cloud services requires changes to organization's current processes.
Optionality: Obligatory
Type: Multiple choice, one selected
Options:
0 = Do not know
1 = Strongly disagree
2 = Disagree
3 = Neutral
4 = Agree
5 = Strongly agree

13. **Question:** Adoption of cloud services requires changes to organization's technological architecture.
Optionality: Obligatory
Type: Multiple choice, one selected
Options:
0 = Do not know
1 = Strongly disagree
2 = Disagree
3 = Neutral
4 = Agree

5 = Strongly agree

14. **Question:** Customization of cloud services to fulfill organization needs is:
Optionality: Obligatory
Type: Multiple choice, one selected
Options:
0 = Do not know
1 = Very difficult
2 = Difficult
3 = Not difficult nor easy
4 = Easy
5 = Very easy

15. **Question**: Use of cloud services is:
Optionality: Obligatory
Type: Multiple choice, one selected
Options:
0 = Do not know
1 = Very difficult
2 = Difficult
3 = Not difficult nor easy
4 = Easy
5 = Very easy

16. **Question:** Getting cloud services to operate as needed is:
Optionality: Obligatory
Type: Multiple choice, one selected
Options:
0 = Do not know
1 = Very difficult
2 = Difficult
3 = Not difficult nor easy
4 = Easy
5 = Very easy

Subsection 3.2: Organization

17. **Question:** Organization's capabilities to adopt cloud services are:
Optionality: Obligatory
Type: Multiple choice, one selected
Options:
0 = Do not know
1 = Very insufficient
2 = Insufficient
3 = Neutral
4 = Sufficient
5 = Very sufficient

18. **Question:** Organization's resources to adopt cloud services are:
Optionality: Obligatory
Type: Multiple choice, one selected
Options:
0 = Do not know
1 = Very insufficient
2 = Insufficient
3 = Neutral
4 = Sufficient
5 = Very sufficient

19. **Question:** Organization's top management understanding for the opportunities of cloud services is:
Optionality: Obligatory
Type: Multiple choice, one selected

Options:
0 = Do not know
1 = Very insufficient
2 = Insufficient
3 = Neutral
4 = Sufficient
5 = Very sufficient

20. **Question:** Organization's top management support for cloud services is:
Optionality: Obligatory
Type: Multiple choice, one selected
Options:
0 = Do not know
1 = Very insufficient
2 = Insufficient
3 = Neutral
4 = Sufficient
5 = Very sufficient

Subsection 3.3: Environment

21. **Question:** Competitors have already implemented cloud services.
Optionality: Obligatory
Type: Multiple choice, one selected
Options:
0 = Do not know
1 = Strongly disagree
2 = Disagree
3 = Neutral
4 = Agree
5 = Strongly agree

22. **Question:** Competitors are able to react to their customer needs more quickly due to cloud services.
Optionality: Obligatory
Type: Multiple choice, one selected
Options:
0 = Do not know
1 = Strongly disagree
2 = Disagree
3 = Neutral
4 = Agree
5 = Strongly agree

23. **Question:** Business partners have already implemented cloud services.
Optionality: Obligatory
Type: Multiple choice, one selected
Options:
0 = Do not know
1 = Strongly disagree
2 = Disagree
3 = Neutral
4 = Agree
5 = Strongly agree

24. **Question:** Cloud services are required to enable collaboration with business partners.
Optionality: Obligatory
Type: Multiple choice, one selected
Options:
0 = Do not know
1 = Strongly disagree
2 = Disagree
3 = Neutral

4 = Agree
5 = Strongly agree

Subsection 3.4: Cloud adoption determinants

25. **Question:** Which following items have negative impact on cloud adoption in your organization?
Optionality: Obligatory
Type: Multiple choice, multiple can be selected
Options:
Security
Data privacy
Multitenancy
Virtual servers
Availability
Reliability
Lack of control over service
Dependence on service
Dependence on provider
Lack of standards
Service location
Costs
None above
Other

Section 4: Cloud adoption success

26. Question: Assess the importance of the following factors for successful cloud adoption.
Optionality: Obligatory
Type: Matrix
Options:
0 = do not know
1 = not important at all
2 = slightly important
3 = important
4 = Very important
5 = Extremely important
Items in rows:

Compatibility between organization's processes and cloud services
Complexity of processes and tasks moving to cloud
Organization's IT architecture
Organization's attitude towards cloud services
Users' attitude towards the use of cloud services
Organization's trust in cloud services
Consideration of user expectations
State of relationship between users and developers
Management support for cloud adoption
User involvement in cloud service implementation project
Actions to motivate employees to use cloud services
Organization's culture and policies
Organization's knowledge and competence on cloud services

Section 5: End and personalized report

27. **Question:** Please share your feedback or questions in here.
Optionality: Optional
Type: Open text field

28. **Question:** Would you like to receive personalized report about the survey results? It will be delivered in December 2019.
    Optionality: Obligatory
    Type: Multiple choice

    Options:
    Yes
    No

29. **Question:** Name
    Optionality: Obligatory, shown if answer to question 28 was yes
    Type: Open text field

30. **Question**: Email
    Optionality: Obligatory, shown if answer to question 28 was yes
    Type: Open text field

31. **Question:** Organization
    Optionality: Obligatory, shown if answer to question 28 was yes
    Type: Open text field

32. **Question:** Job title
    Optionality: Obligatory, shown if answer to question 28 was yes
    Type: Open text field

APPENDIX C: SURVEY COVER LETTER

To: Undersigned
Bcc: Recipients
Subject: Survey on cloud adoption as part of master's thesis

We have been working with our Finnish customers over the years and accompanied them to transform core business processes to cloud. We would like to hear now your point of view on cloud adoption and therefore, we have created a survey to gather your valuable insights. Survey results will be used to analyze the state, determinants and success of cloud adoption in Finnish organizations.

All answers are treated anonymously and will be further analyzed as a part of master's thesis that will be available for audience. All interested participants have an opportunity to receive personalized report to examine the results in December 2019.

Survey will take approximately 20 min and we hope to receive your respond by Friday 27th of September 2019. Please feel free to share this survey with others in your organization. Please note that it is not obligatory for the organization to have adopted cloud services to participate.

The survey is available in here.

Thank you in advance. Your feedback is very much appreciated.

APPENDIX D: SURVEY RESULTS

Question 1: *Please choose the industry in which your organization operates.*

Distribution of respondents' choices for their organization's industry categories.

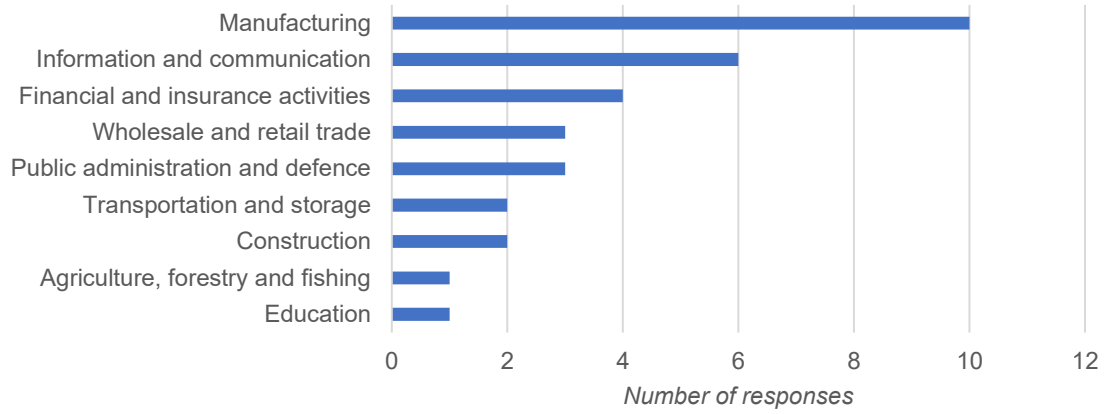

Table representing the number of responses per category and their proportion of all responses.

Variable	**Number of responses**	**Proportion**
Agriculture, forestry and fishing	1	3,125 %
Manufacturing	10	31, 25 %
Construction	2	6,25 %
Wholesale and retail trade	3	9,375 %
Transportation and storage	2	6,25 %
Information and communication	6	18,75 %
Financial and insurance activities	4	12,50 %
Public administration and defence	3	9,375 %
Education	1	3,125 %
Electricity, gas, steam and air conditioning supply	0	0,00 %
Water supply, sewerage, waste management and remediation activities	0	0,00 %
Professional, scientific and technical activities	0	0,00 %
Administrative and support service activities	0	0,00 %
Human health and social work activities	0	0,00 %
Arts, entertainment and recreation	0	0,00 %

Question 2: *What is your responsibility area in your organization?*

Distribution of respondents' choices for their responsibility area categories.

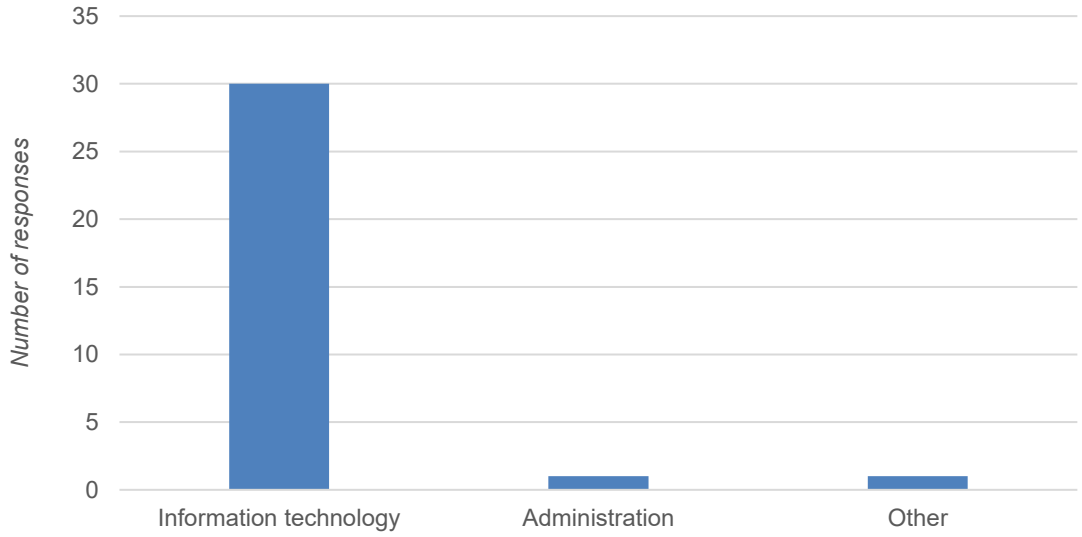

Table representing the number of responses per category and their proportion of all responses.

Variable	**Number of responses**	**Proportion**
Information technology	30	93,75 %
Administration	1	3,125%
Other	1	3,125 %
Production	0	0,00 %
Operations	0	0,00 %
Finance	0	0,00 %
Human resources	0	0,00 %
Sales and marketing	0	0,00 %
Purchasing	0	0,00 %
Legal	0	0,00 %
Research and development	0	0,00 %

Given specifications when "other" was chosen:

Response	**Specification**
1	IoT

Question 3: *Please assess the state of cloud adoption in your organization*

Distribution of respondents' choices for their assessment of cloud adoption state on a given scale.

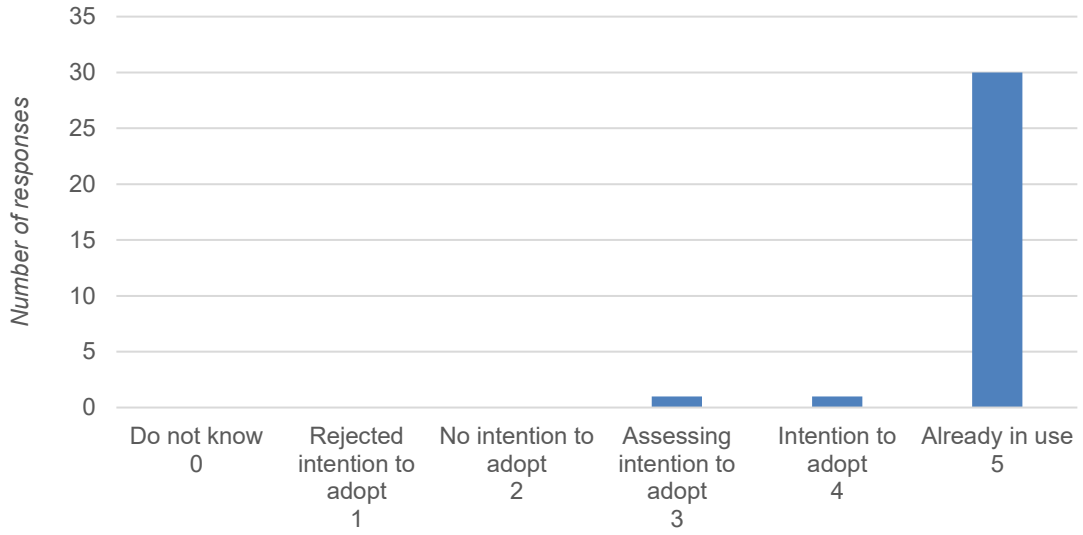

Table representing the calculated variables of the responses.

Variable	**Value**
Mode	5
Median	5
Standard deviation	0,39

Table representing the number of responses per scale item and their proportion of all responses.

Variable	**Number of responses**	**Proportion**
Organization has cloud services already in use	30	93,75 %
Organization has intention to adopt cloud services	1	3,125%
Organization is assessing the intention to adopt cloud services	1	3,125 %
Organization has no intention to adopt cloud services	0	0 %
Organization has assessed and rejected the intention to adopt cloud services	0	0 %
Don't know	0	0 %

Question 4: *Please choose the providers whose cloud services you have experience on.*

Distribution of mentions per provider based on the given choices.

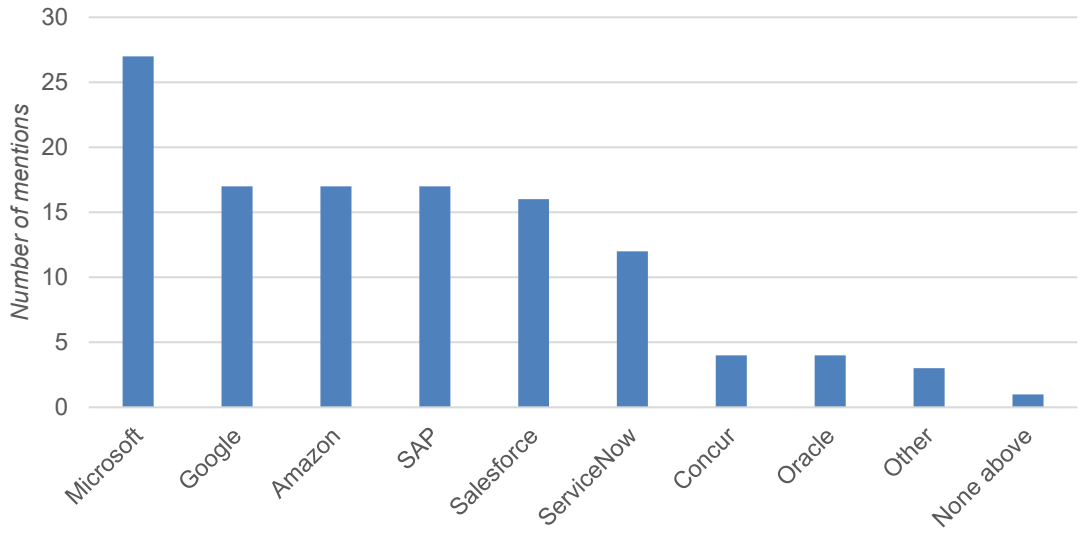

Table representing the number of responses per scale item and proportion of mentions compared to the number of respondents.

Variable	**Number of mentions**	**Proportion**
Salesforce	16	50,00 %
Microsoft	27	84,38 %
Google	17	53,13 %
Amazon	17	53,13 %
Concur	4	12,50 %
SAP	16	50,00 %
Oracle	4	12,50 %
ServiceNow	12	37,50 %
None above	1	3,13 %
Other	3	9,38 %

Given specifications when “other” was chosen:

Response	**Specification**
1	SuccessFactors, Congrid
2	QAD (ERP), Solaforce (HRIS), some other smaller systems
3	Smaller SaaS providers

Question 5: *Please elaborate which kind of processes have been already moved to cloud in your organization.*

Distribution of mentions per area based on the given choices.

This question was only shown to people that had selected choice number 5 in question 3.

Variable	Value
n	30

Table representing the number of responses per scale item and proportion of mentions compared to the number of respondents for this question.

Variable	Number of mentions	Proportion
Enterprise resource planning	8	26,67 %
Inventory and supply chain management	7	23,33 %
Billing and invoicing	10	33,33 %
Accounting	7	23,33 %
Reporting and planning	16	53,33 %
Human resources	20	66,67 %
Sales	15	46,88 %
Marketing	13	50,00 %
Customer relationship management	19	63,33 %
Collaboration	23	76,67 %
Other	6	20,00 %

Given specifications when “other” was chosen:

Response	Specification
1	IT and application infra
2	IoT Services and application infra
3	Cloud based IoT and data driven services
4	IT Services
5	Infrastructure as a service
6	Design, knowledge management and office tools

Distribution of respondents based on the amount of process categories moved to cloud in an organization.

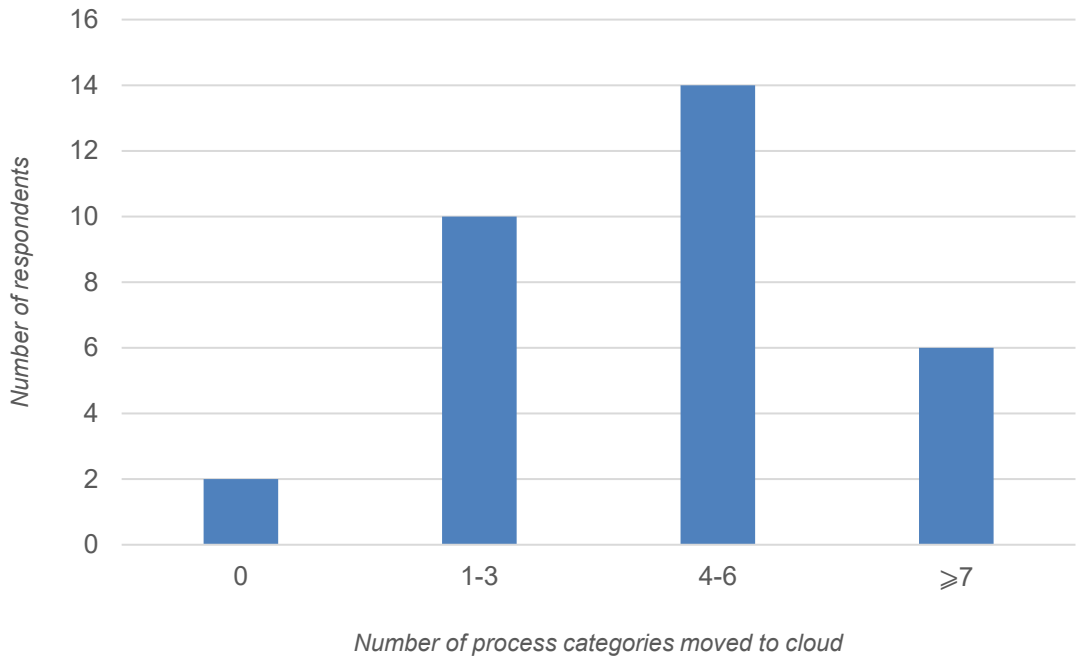

Table representing the categorization of the respondents based on the extent of processes moved to cloud.

Variable	Number of respondents	Proportion
0 processes moved to cloud	2	6,25 %
1-3 kinds of processes moved to cloud	10	31,25 %
4-6 kinds of processes moved to cloud	14	43,75 %
7-9 kinds of processes moved to cloud	1	3,125 %
10 kinds of processes moved to cloud	5	15,625 %

Question 6: *Please elaborate which kind of processes will be moved to cloud in your organization during the next 1-3 years.*

Distribution of mentions per area based on the given choices.

This question was only shown to people that had selected choices number 3-5 in question 3.

Variable	**Value**
n	32

Table representing the number of responses per scale item and proportion of mentions compared to the number of respondents.

Variable	**Number of mentions**	**Proportion**
Enterprise resource planning	13	40,63 %
Inventory and supply chain management	8	25,00 %
Billing and invoicing	10	31,25 %
Accounting	8	25,00 %
Reporting and planning	9	28,13 %
Human resources	10	31,25 %
Sales	7	21,88 %
Marketing	10	31,25 %
Customer relationship management	9	28,13 %
Collaboration	8	25,00 %
Other	9	28,13 %

Given specifications when “other” was chosen:

Response	Specification
1	Some local services
2	Unknown at the moment
3	I don’t know the plans
4	Data analytics
5	Depends on private vs. public cloud on e.g. ERP related changes – so hard to answer
6	Service and maintenance, this is like an ERP for our service business
7	All new systems will be built in the cloud, currently no on-premise
8	We are fully in cloud
9	Infrastructure as a service

Question 7: *Cloud services' effect on agility of business operation is:*

Distribution of respondents' choices based on their assessment on a given scale.

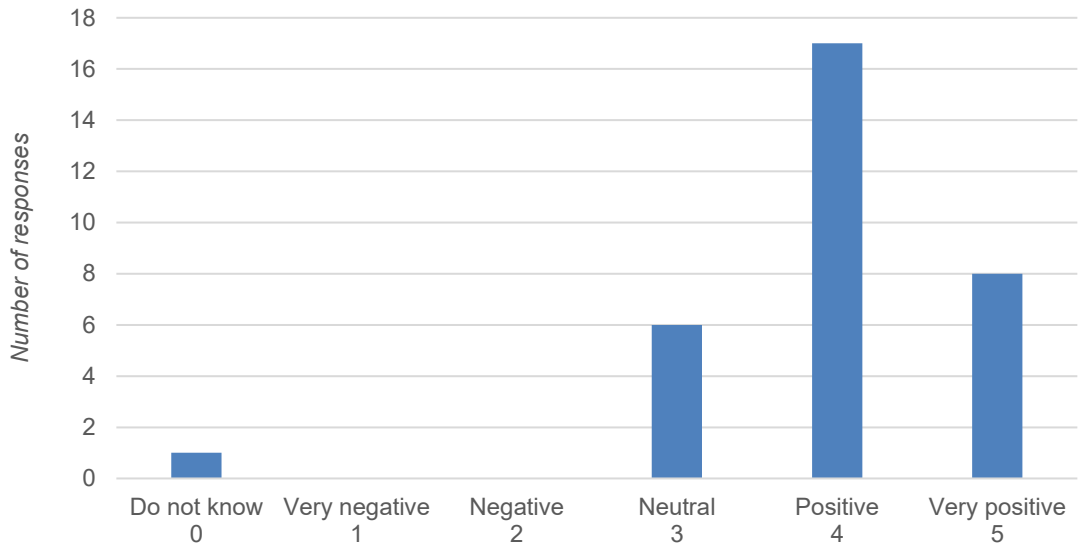

Table representing the calculated variables of the responses.

Variable	**Value**
Mode	4
Median	4
Standard deviation	0,68

Table representing the number of responses per scale item and their proportion of all responses.

Variable	**Number of responses**	**Proportion**
Do not know	1	3,125 %
Very negative	0	0,00 %
Negative	0	0,00 %
Neutral	6	18,75 %
Positive	17	53,125 %
Very positive	8	25,00 %

Question 8: *Cloud services' effect on organization's ability to react more quickly to changes is:*

Distribution of respondents' choices based on their assessment on a given scale.

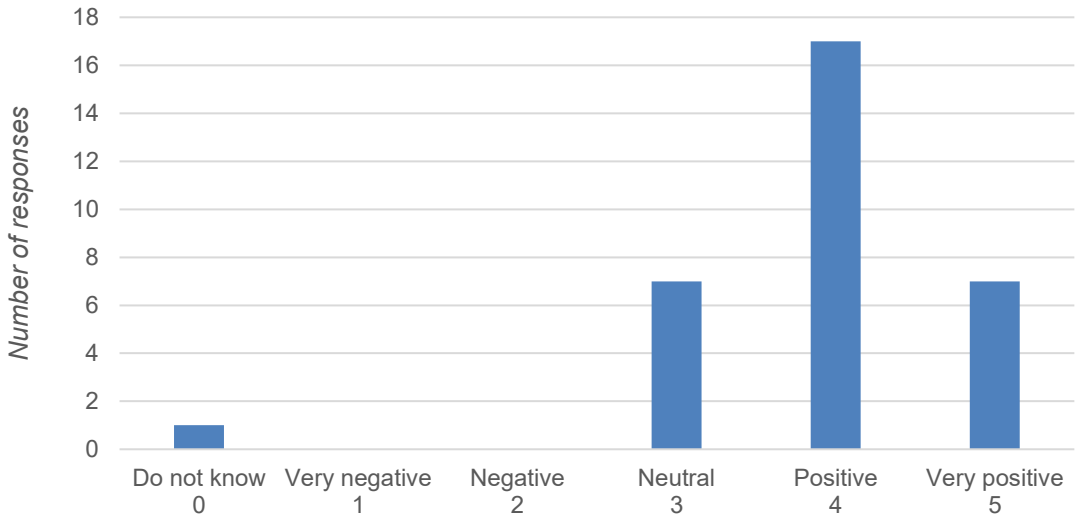

Table representing the calculated variables of the responses.

Variable	**Value**
Mode	4
Median	4
Standard deviation	0,68

Table representing the number of responses per scale item and their proportion of all responses.

Variable	**Number of responses**	**Proportion**
Do not know	1	3,125 %
Very negative	0	0,00 %
Negative	0	0,00 %
Neutral	7	21,875 %
Positive	17	53,125 %
Very positive	7	21,875 %

Question 9: *Cloud services' effect on productivity of operations is:*

Distribution of respondents' choices based on their assessment on a given scale.

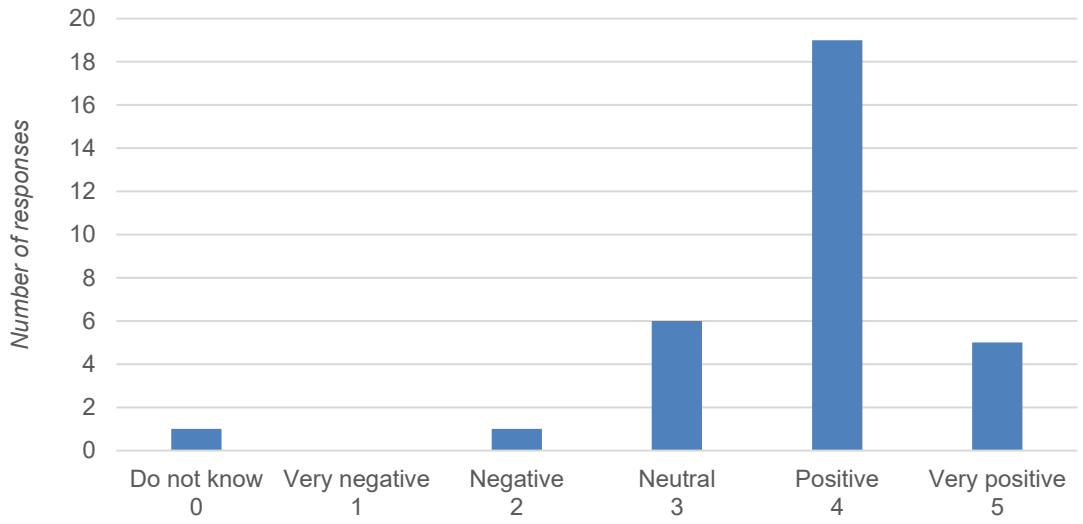

Table representing the calculated variables of the responses.

Variable	**Value**
Mode	4
Median	4
Standard deviation	0,70

Table representing the number of responses per scale item and their proportion of all responses.

Variable	**Number of responses**	**Proportion**
Do not know	1	3,125 %
Very negative	0	0,00 %
Negative	1	3,125 %
Neutral	6	18,75 %
Positive	19	59,375 %
Very positive	5	15,625 %

Question 10: *Cloud services' effect on customer experience is:*

Distribution of respondents' choices based on their assessment on a given scale.

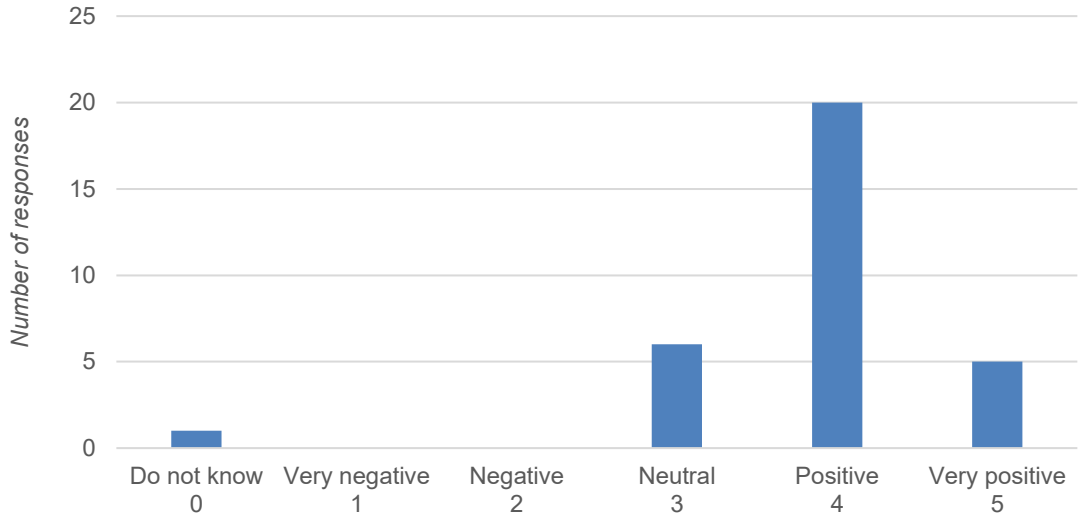

Table representing the calculated variables of the responses.

Variable	**Value**
Mode	4
Median	4
Standard deviation	0,60

Table representing the number of responses per scale item and their proportion of all responses.

Variable	**Number of responses**	**Proportion**
Do not know	1	3,125 %
Very negative	0	0,00 %
Negative	0	0,00 %
Neutral	6	18,75 %
Positive	20	62,50 %
Very positive	5	15,625 %

Question 11: *Cloud services' effect on organization's operational costs is:*

Distribution of respondents' choices based on their assessment on a given scale.

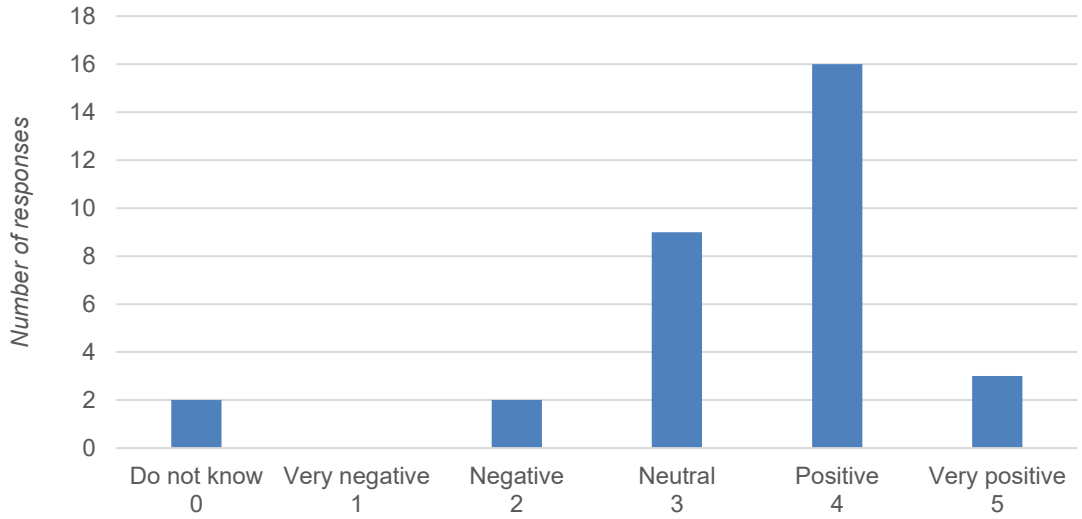

Table representing the calculated variables of the responses.

Variable	**Value**
Mode	4
Median	4
Standard deviation	0,76

Table representing the number of responses per scale item and their proportion of all responses.

Variable	**Number of responses**	**Proportion**
Do not know	2	6,25 %
Very negative	0	0,00 %
Negative	2	6,25 %
Neutral	9	28,125 %
Positive	16	50,00 %
Very positive	3	9,375 %

Question 12: *Adoption of cloud services requires changes to organization's current processes.*

Distribution of respondents' choices based on their assessment on a given scale.

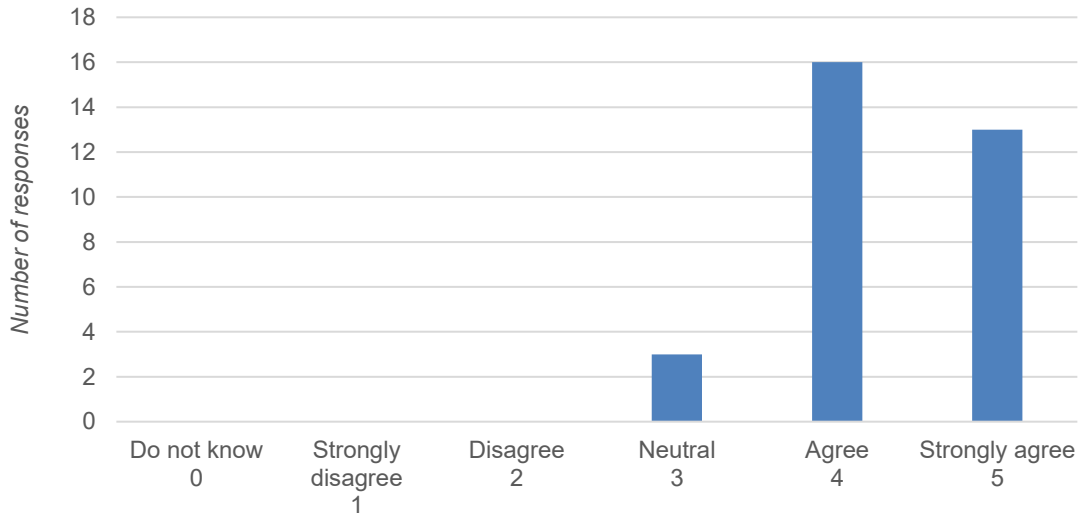

Table representing the calculated variables of the responses.

Variable	**Value**
Mode	4
Median	4
Standard deviation	0,64

Table representing the number of responses per scale item and their proportion of all responses.

Variable	**Number of responses**	**Proportion**
Do not know	0	0,00 %
Strongly disagree	0	0,00 %
Disagree	0	0,00 %
Neutral	3	9,375 %
Agree	16	50,00 %
Strongly agree	13	40,625 %

Question 13: *Adoption of cloud services requires changes to organization's technological architecture.*

Distribution of respondents' choices based on their assessment on a given scale.

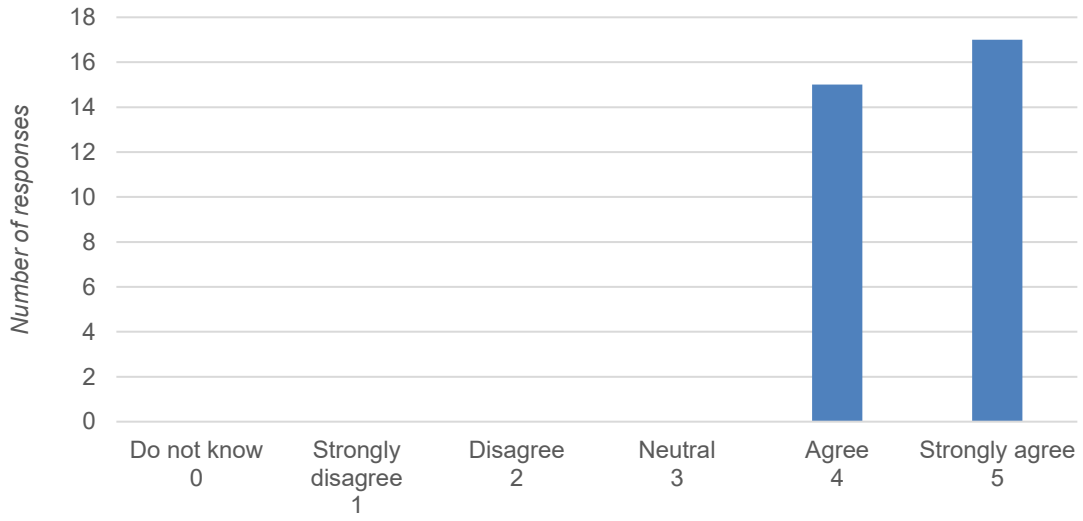

Table representing the calculated variables of the responses.

Variable	**Value**
Mode	5
Median	5
Standard deviation	0,51

Table representing the number of responses per scale item and their proportion of all responses.

Variable	**Number of responses**	**Proportion**
Do not know	0	0,00 %
Strongly disagree	0	0,00 %
Disagree	0	0,00 %
Neutral	0	0,00 %
Agree	15	46,875 %
Strongly agree	17	53,125 %

Question 14: *Customization of cloud services to fulfill organization needs is:*

Distribution of respondents' choices based on their assessment on a given scale.

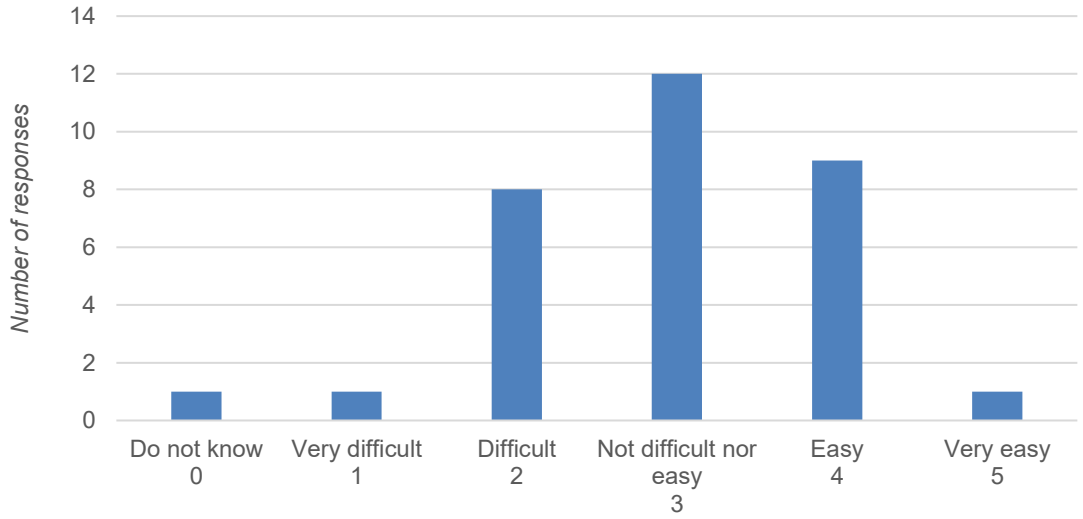

Table representing the calculated variables of the responses.

Variable	**Value**
Mode	3
Median	3
Standard deviation	0,91

Table representing the number of responses per scale item and their proportion of all responses.

Variable	**Number of responses**	**Proportion**
Do not know	1	3,125 %
Very difficult	1	3,125 %
Difficult	8	25,00 %
Not difficult nor easy	12	37,50 %
Easy	9	28,125 %
Very easy	1	3,125 %

Question 15: *Use of cloud services is:*

Distribution of respondents' choices based on their assessment on a given scale.

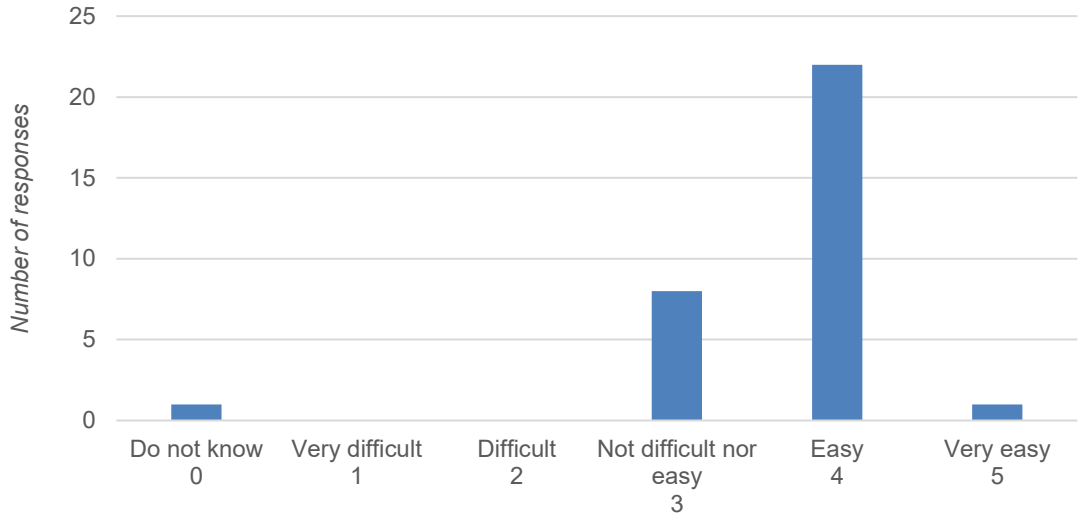

Table representing the calculated variables of the responses.

Variable	**Value**
Mode	4
Median	4
Standard deviation	0,49

Table representing the number of responses per scale item and their proportion of all responses.

Variable	**Number of responses**	**Proportion**
Do not know	1	3,125 %
Very difficult	0	0,00 %
Difficult	0	0,00 %
Not difficult nor easy	8	25,00 %
Easy	22	68,75 %
Very easy	1	3,125 %

Question 16: *Getting cloud services to operate as needed is:*

Distribution of respondents' choices based on their assessment on a given scale.

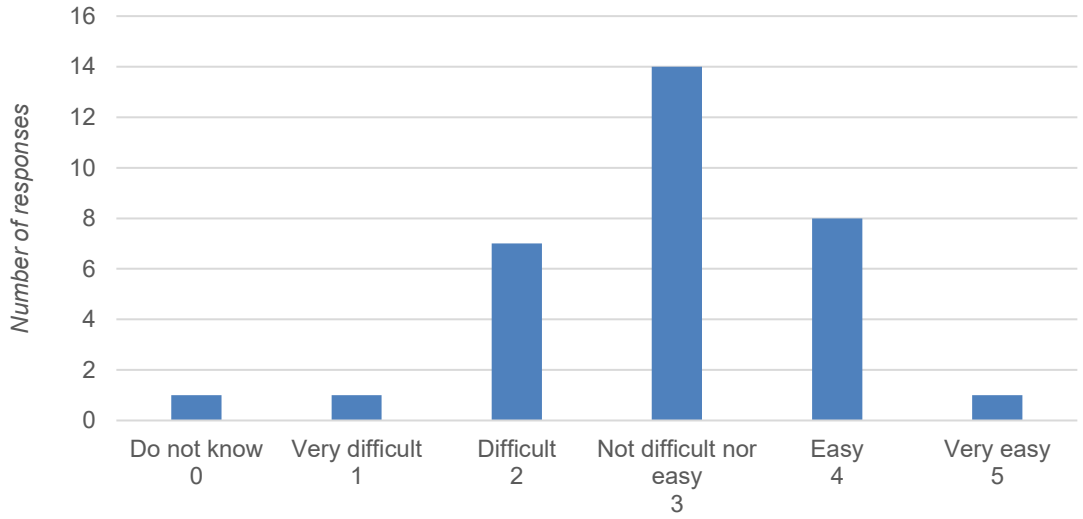

Table representing the calculated variables of the responses.

Variable	**Value**
Mode	3
Median	3
Standard deviation	0,87

Table representing the number of responses per scale item and their proportion of all responses.

Variable	**Number of responses**	**Proportion**
Do not know	1	3,125 %
Very difficult	1	3,125 %
Difficult	7	21,875 %
Not difficult nor easy	14	43,75 %
Easy	8	25,00 %
Very easy	1	3,125 %

Question 17: *Organization's capabilities to adopt cloud services are:*

Distribution of respondents' choices based on their assessment on a given scale.

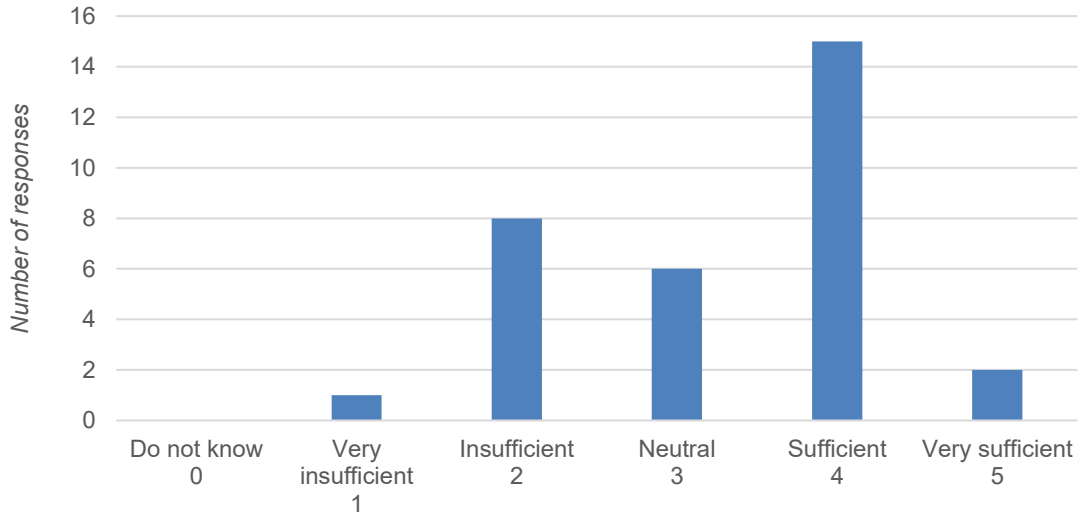

Table representing the calculated variables of the responses.

Variable	**Value**
Mode	4
Median	4
Standard deviation	1,02

Table representing the number of responses per scale item and their proportion of all responses.

Variable	**Number of responses**	**Proportion**
Do not know	0	0,00 %
Very insufficient	1	3,125 %
Insufficient	8	25,00 %
Neutral	6	18,75 %
Sufficient	15	46,875 %
Very sufficient	2	6,25 %

Question 18: *Organization's resources to adopt cloud services are:*

Distribution of respondents' choices based on their assessment on a given scale.

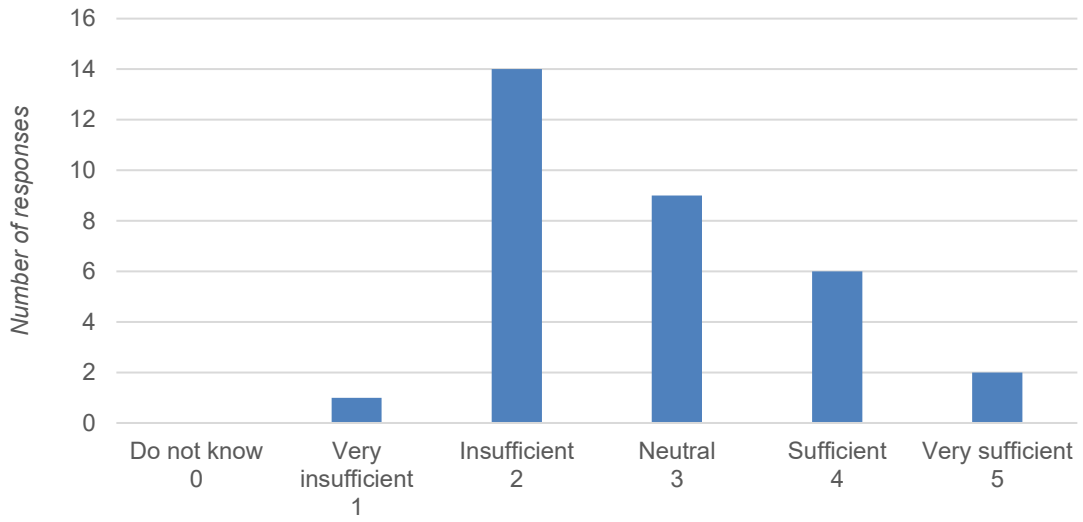

Table representing the calculated variables of the responses.

Variable	**Value**
Mode	2
Median	3
Standard deviation	1,00

Table representing the number of responses per scale item and their proportion of all responses.

Variable	**Number of responses**	**Proportion**
Do not know	0	0,00 %
Very insufficient	1	3,125 %
Insufficient	14	43,75 %
Neutral	9	28,125 %
Sufficient	6	18,75 %
Very sufficient	2	6,25 %

Question 19: *Organization's top management understanding for the opportunities of cloud services is:*

Distribution of respondents' choices based on their assessment on a given scale.

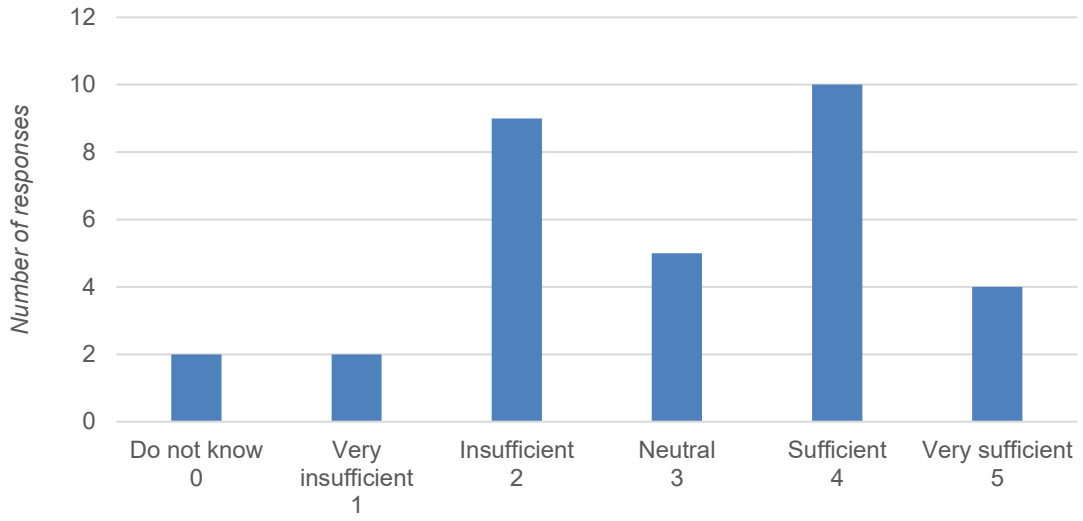

Table representing the calculated variables of the responses.

Variable	**Value**
Mode	4
Median	3
Standard deviation	1,21

Table representing the number of responses per scale item and their proportion of all responses.

Variable	**Number of responses**	**Proportion**
Do not know	2	6,25 %
Very insufficient	2	6,25 %
Insufficient	9	28,125 %
Neutral	5	15,625 %
Sufficient	10	31,25 %
Very sufficient	4	12,50 %

Question 20: *Organization's top management support for cloud services is:*

Distribution of respondents' choices based on their assessment on a given scale.

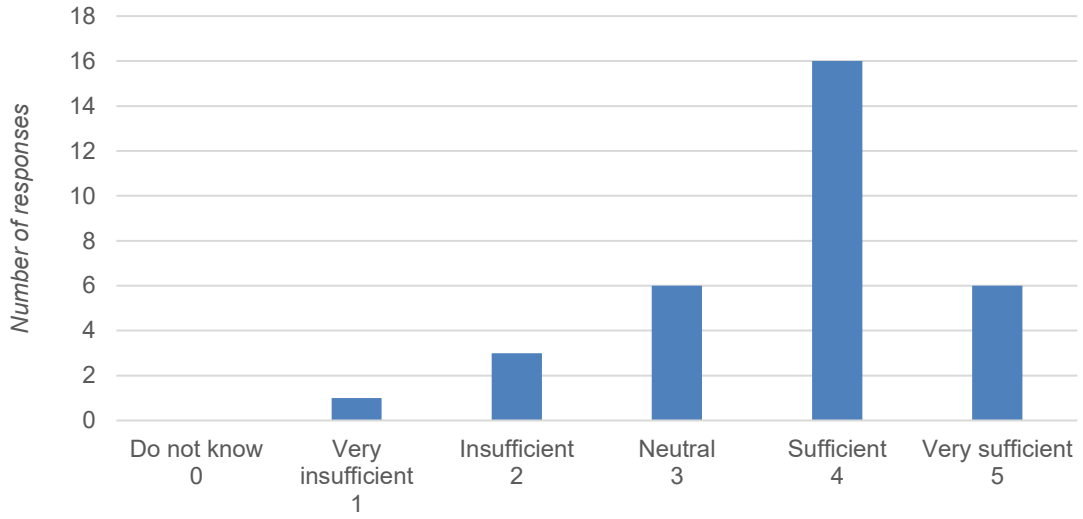

Table representing the calculated variables of the responses.

Variable	**Value**
Mode	4
Median	4
Standard deviation	0,99

Table representing the number of responses per scale item and their proportion of all responses.

Variable	**Number of responses**	**Proportion**
Do not know	0	0,00 %
Very insufficient	1	3,125 %
Insufficient	3	9,375 %
Neutral	6	18,75 %
Sufficient	16	50,00 %
Very sufficient	6	18,75 %

Question 21: *Competitors have already implemented cloud services.*

Distribution of respondents' choices based on their assessment on a given scale.

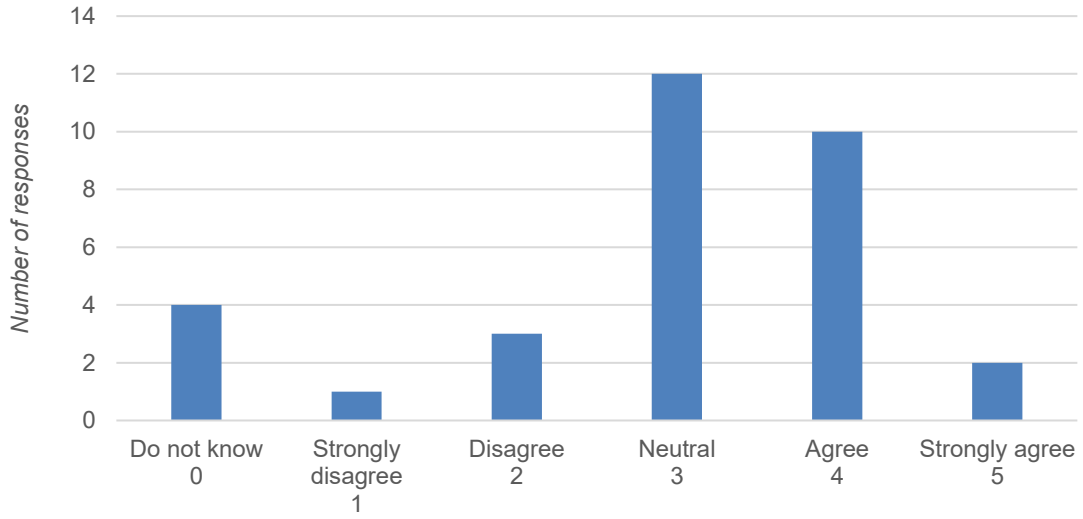

Table representing the calculated variables of the responses.

Variable	**Value**
Mode	3
Median	3
Standard deviation	1,08

Table representing the number of responses per scale item and their proportion of all responses.

Variable	**Number of responses**	**Proportion**
Do not know	4	12,50 %
Strongly disagree	1	3,125 %
Disagree	3	9,375 %
Neutral	12	37,50 %
Agree	10	31,25 %
Strongly disagree	2	6,25 %

Question 22: *Competitors are able to react to their customer needs more quickly due to cloud services.*

Distribution of respondents' choices based on their assessment on a given scale.

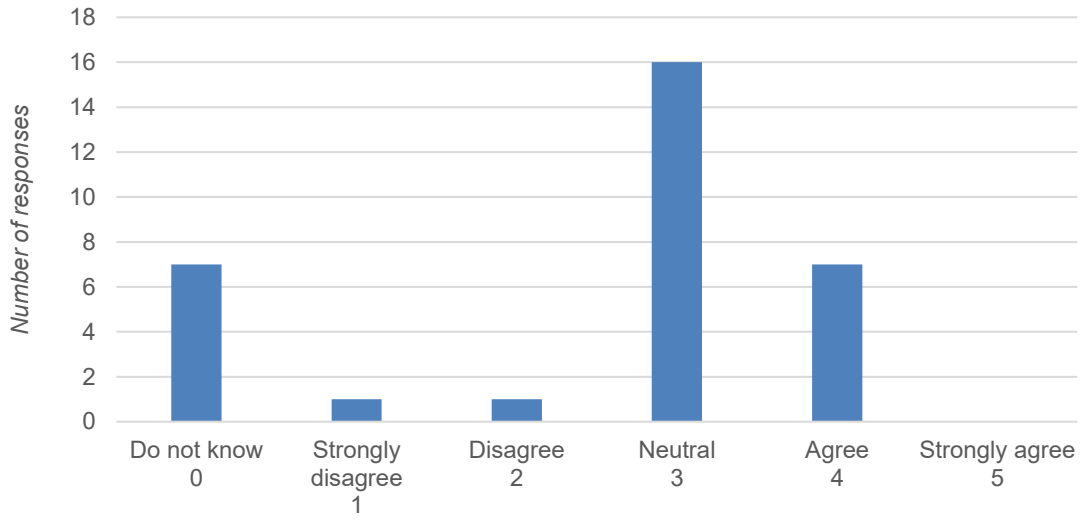

Table representing the calculated variables of the responses.

Variable	**Value**
Mode	3
Median	3
Standard deviation	0,69

Table representing the number of responses per scale item and their proportion of all responses.

Variable	**Number of responses**	**Proportion**
Do not know	7	21,875 %
Strongly disagree	1	3,125 %
Disagree	1	3,125 %
Neutral	16	50,00 %
Agree	7	21,875 %
Strongly disagree	0	0,00 %

Question 23: *Business partners have already implemented cloud services.*

Distribution of respondents' choices based on their assessment on a given scale.

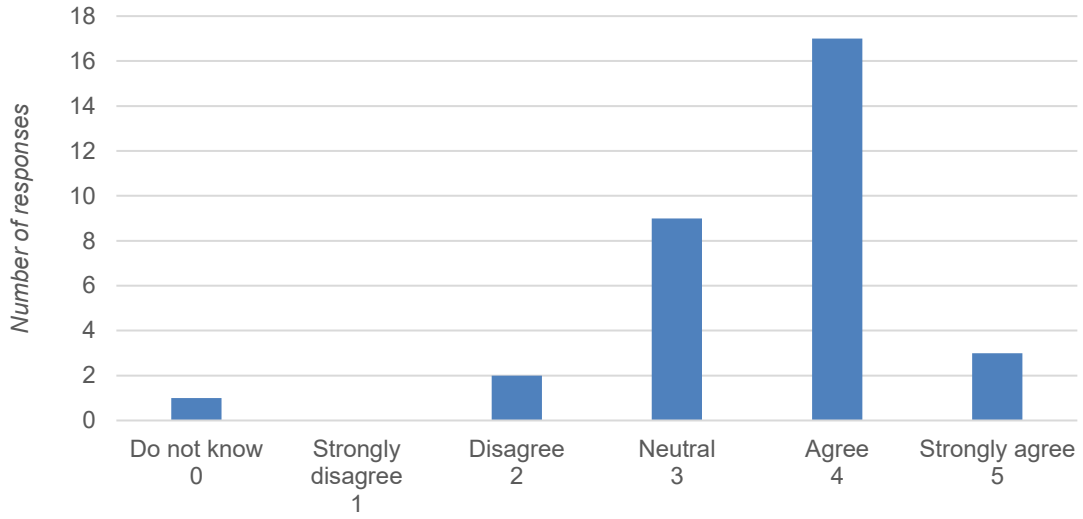

Table representing the calculated variables of the responses.

Variable	**Value**
Mode	4
Median	4
Standard deviation	0,75

Table representing the number of responses per scale item and their proportion of all responses.

Variable	**Number of responses**	**Proportion**
Do not know	1	3,125 %
Strongly disagree	0	0,00 %
Disagree	2	6,25 %
Neutral	9	28,125 %
Agree	17	53,125 %
Strongly disagree	3	9,375 %

Question 24: *Cloud services are required to enable collaboration with business partners.*

Distribution of respondents' choices based on their assessment on a given scale.

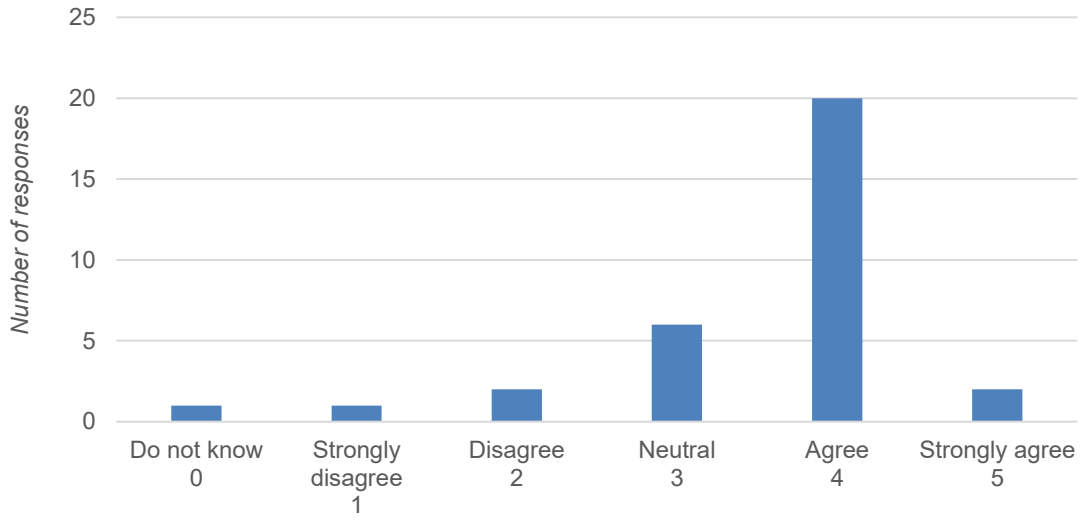

Table representing the calculated variables of the responses.

Variable	**Value**
Mode	4
Median	4
Standard deviation	1,05

Table representing the number of responses per scale item and their proportion of all responses.

Variable	**Number of responses**	**Proportion**
Do not know	1	3,125 %
Strongly disagree	1	3,125 %
Disagree	2	6,25 %
Neutral	6	18,75 %
Agree	20	62,50 %
Strongly disagree	2	6,25 %

Question 25: *Which following items have negative impact on cloud adoption in your organization?*

Distribution of mentions per item based on the given choices.

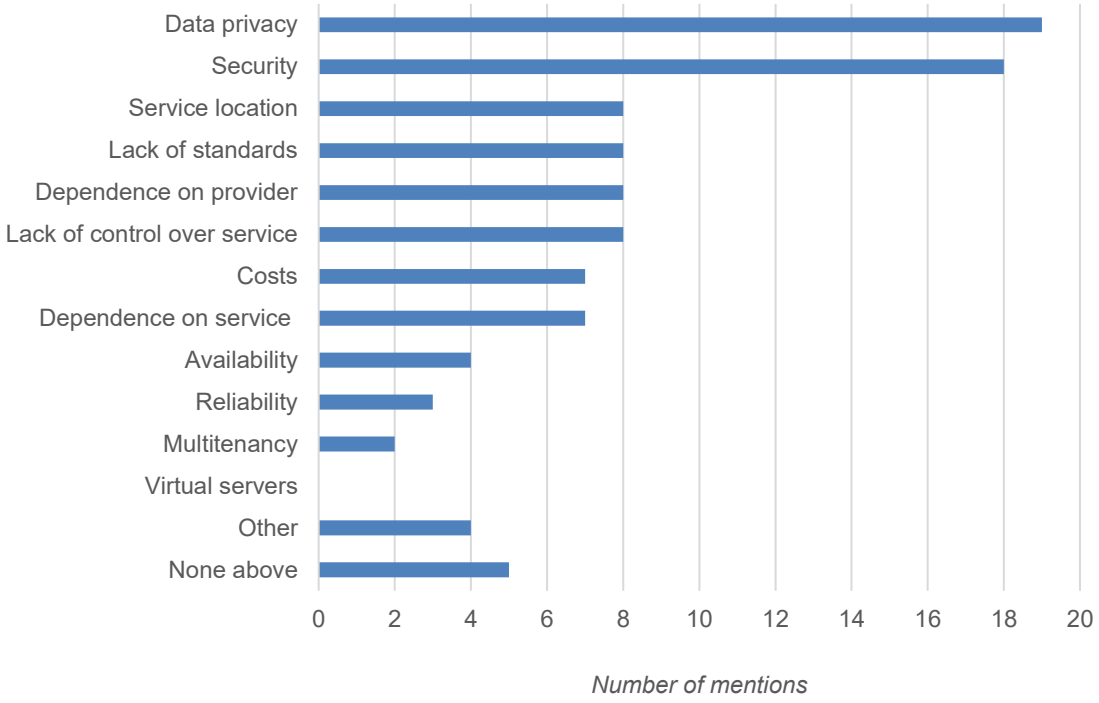

Table representing the number of responses per scale item and proportion of mentions compared to the number of respondents.

Variable	**Number of mentions**	**Proportion**
Security	18	56,25 %
Data privacy	19	59,375 %
Multitenancy	3	9,375 %
Virtual servers	0	0,00 %
Availability	4	12,50 %
Reliability	3	9,375 %
Lack of control over service	8	25,00 %
Dependence on service	8	25,00 %
Dependence on provider	9	28,125 %
Lack of standards	8	25,00 %
Service location	8	25,00 %
Costs	7	21,875 %
None above	5	15,625 %
Other	4	12,50 %

Given specifications when “other” was chosen:

Response	Specification
1	License models are becoming tricky and complex in some services (Salesforce especially). This has been one of the benefits of this kind of services and operating models.
2	Understanding of infrastructure
3	Lack of cloud professionals in the organization
4	Regulatory parties

Question 26: *Assess the importance of the following factors for successful cloud adoption.*

Division of responses for assessing the importance of the IS success determinants.

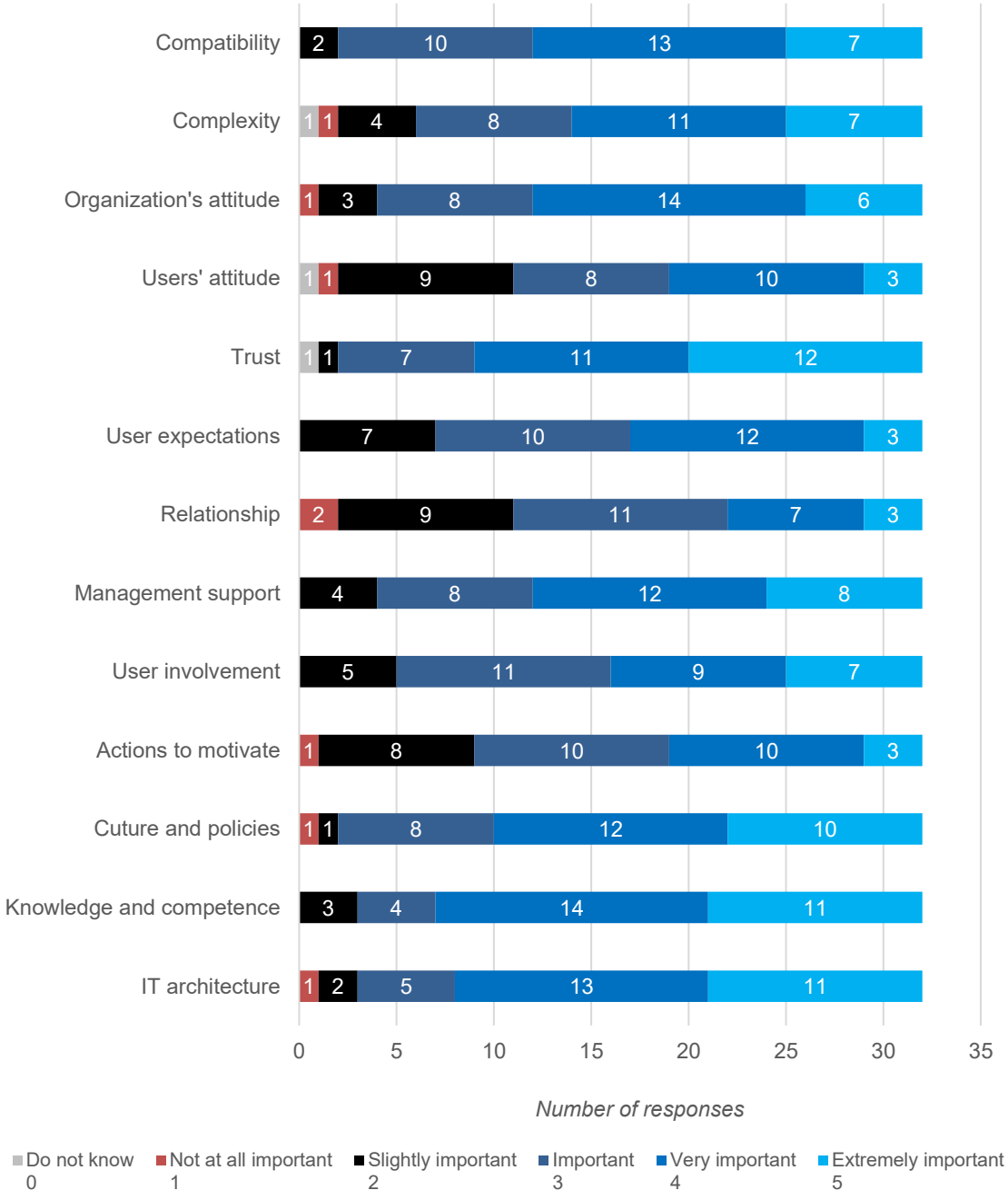

Table representing the calculated variables of the responses.

Variable	Mode	Median	Standard deviation
Compatibility	4	4	0,87
Complexity	4	4	1,09
IT architecture	4	4	1,03
Organization’s attitude	4	4	1,00
Users’ attitude	4	3	1,07
Trust	5	4	0,87
User expectations	4	3	0,94
Relationship	3	3	1,07
Management support	4	4	0,98
User involvement	3	3,5	1,01
Actions to motivate	3	3	1,03
Culture and policies	4	4	1,00
Knowledge and competencies	4	4	0,93

Compatibility between organization's processes and cloud services

Distribution of respondents' choices based on their assessment on a given scale.

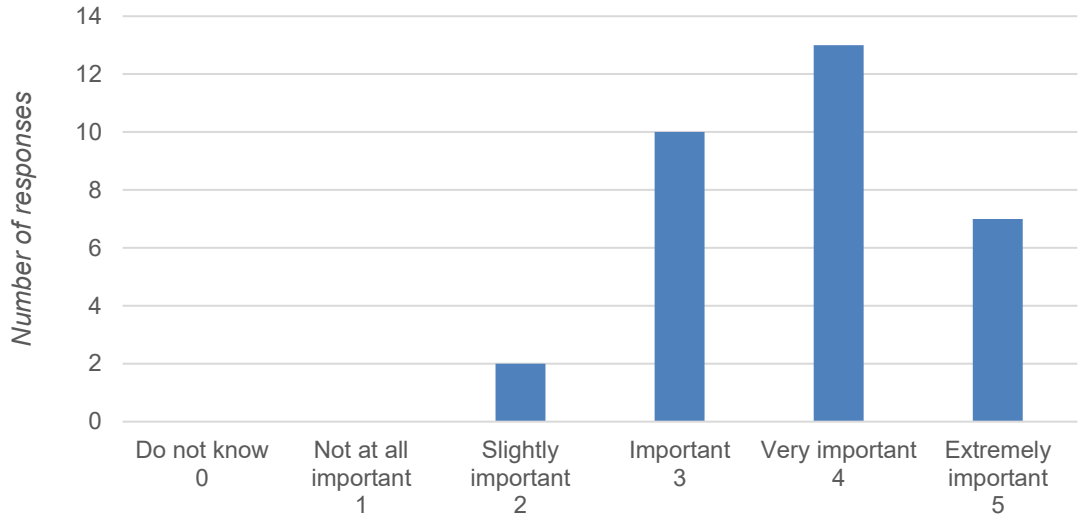

Table representing the calculated variables of the responses.

Variable	Value
Mode	4
Median	4
Standard deviation	0,87

Table representing the number of responses per scale item and their proportion of all responses.

Variable	Number of responses	Proportion
Do not know	0	0,00 %
Not at all important	0	0,00 %
Slightly important	2	6,25 %
Important	10	31,25 %
Very important	13	40,625 %
Extremely important	7	21,875 %

Complexity of processes and tasks moving to cloud

Distribution of respondents' choices based on their assessment on a given scale.

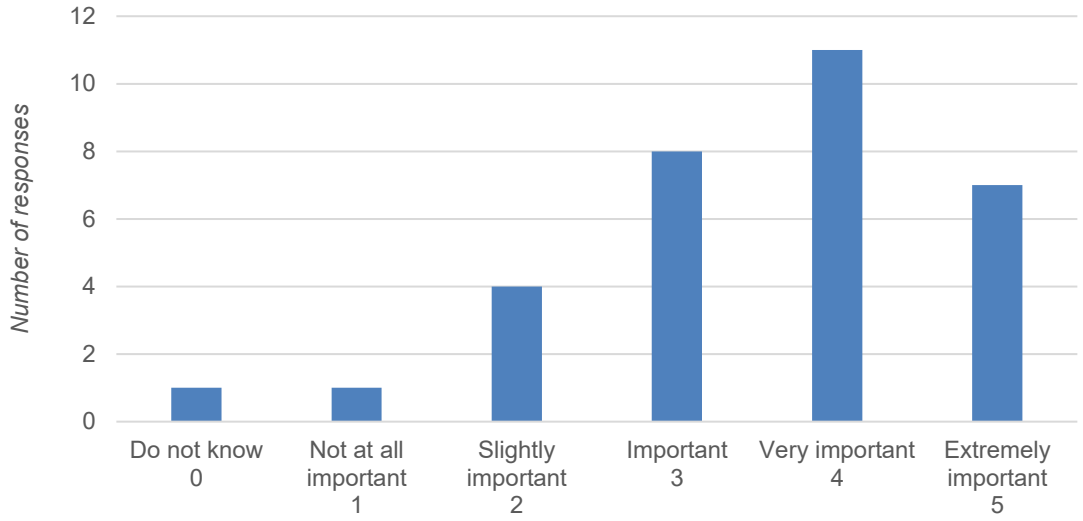

Table representing the calculated variables of the responses.

Variable	**Value**
Mode	4
Median	4
Standard deviation	1,09

Table representing the number of responses per scale item and their proportion of all responses.

Variable	**Number of responses**	**Proportion**
Do not know	1	3,125 %
Not at all important	1	3,125 %
Slightly important	4	12,50 %
Important	8	25,00 %
Very important	11	34,375 %
Extremely important	7	21,875 %

Organization's IT architecture

Distribution of respondents' choices based on their assessment on a given scale.

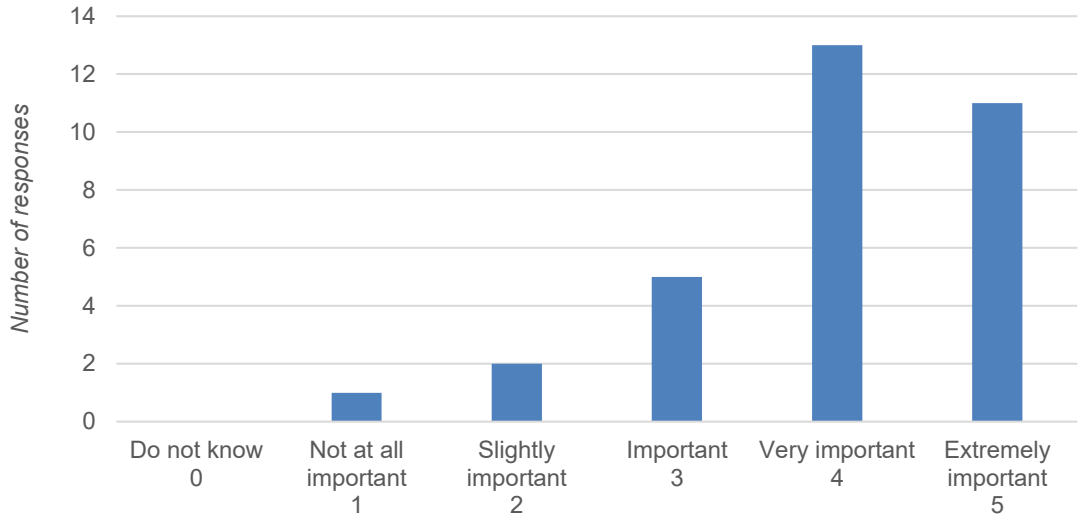

Table representing the calculated variables of the responses.

Variable	Value
Mode	4
Median	4
Standard deviation	1,03

Table representing the number of responses per scale item and their proportion of all responses.

Variable	Number of responses	Proportion
Do not know	0	0,00 %
Not at all important	1	3,125 %
Slightly important	2	6,25 %
Important	5	15,625 %
Very important	13	40,625 %
Extremely important	11	34,375 %

Organization's attitude towards cloud services

Distribution of respondents' choices based on their assessment on a given scale.

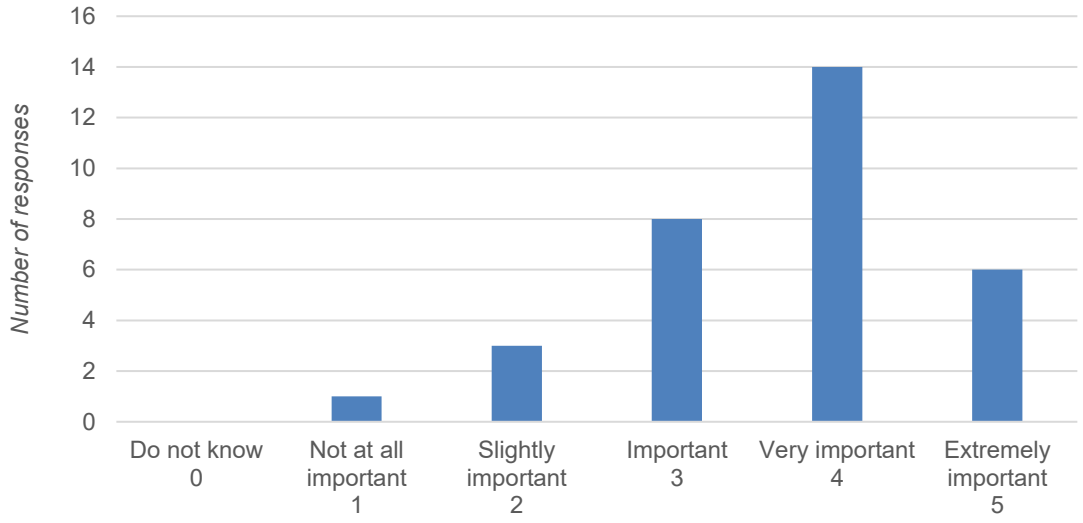

Table representing the calculated variables of the responses.

Variable	**Value**
Mode	4
Median	4
Standard deviation	1,00

Table representing the number of responses per scale item and their proportion of all responses.

Variable	**Number of responses**	**Proportion**
Do not know	0	0,00 %
Not at all important	1	3,125 %
Slightly important	3	9,375 %
Important	8	25,00 %
Very important	14	43,75 %
Extremely important	6	18,75 %

Users' attitude towards the use of cloud services

Distribution of respondents' choices based on their assessment on a given scale.

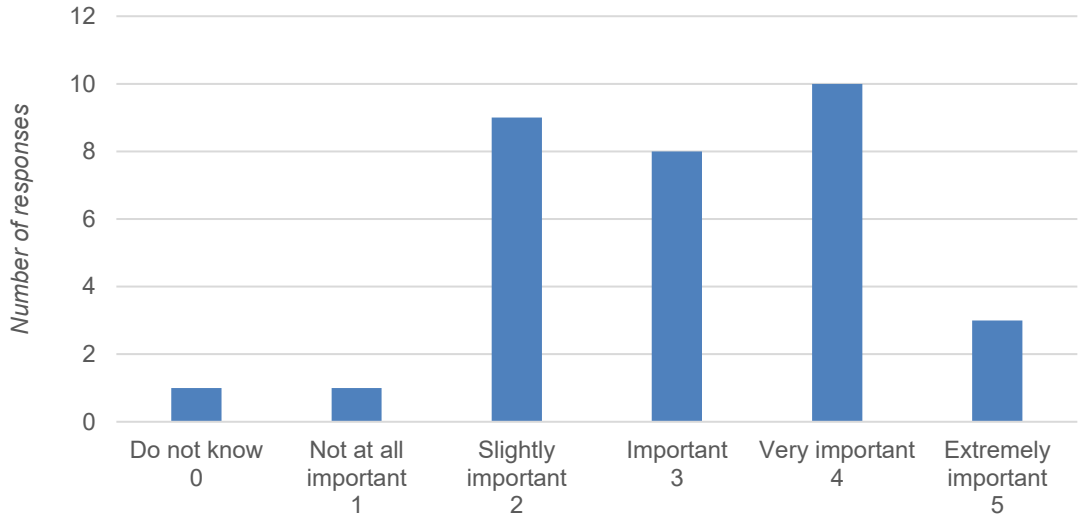

Table representing the calculated variables of the responses.

Variable	**Value**
Mode	4
Median	3
Standard deviation	1,07

Table representing the number of responses per scale item and their proportion of all responses.

Variable	**Number of responses**	**Proportion**
Do not know	1	3,125 %
Not at all important	1	3,125 %
Slightly important	9	28,125 %
Important	8	25,00 %
Very important	10	31,25 %
Extremely important	3	9,375 %

Organization's trust in cloud services

Distribution of respondents' choices based on their assessment on a given scale.

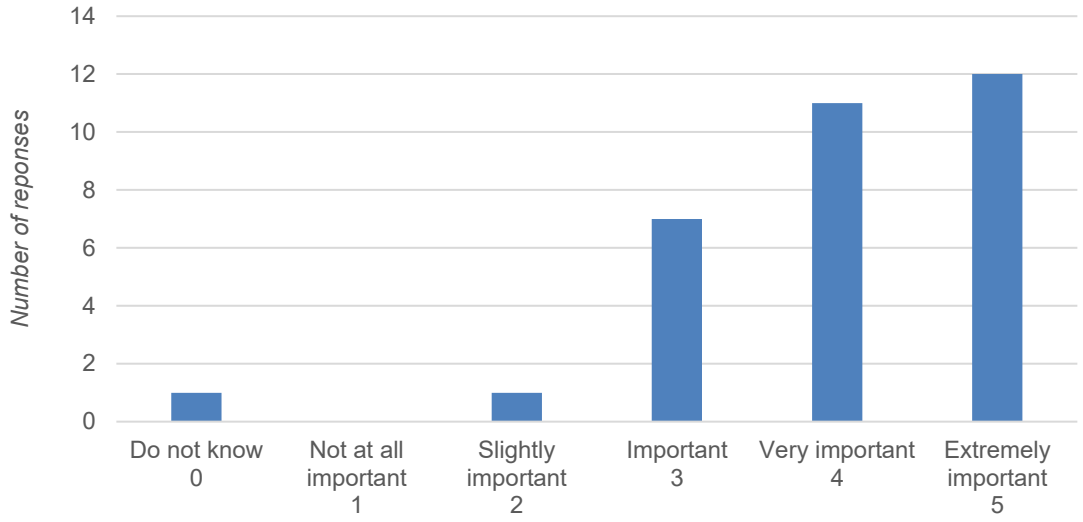

Table representing the calculated variables of the responses.

Variable	**Value**
Mode	5
Median	4
Standard deviation	0,87

Table representing the number of responses per scale item and their proportion of all responses.

Variable	**Number of responses**	**Proportion**
Do not know	1	3,125 %
Not at all important	0	0,00 %
Slightly important	1	3,125 %
Important	7	21,875 %
Very important	11	34,375 %
Extremely important	12	37,50 %

Consideration of user expectations

Distribution of respondents' choices based on their assessment on a given scale.

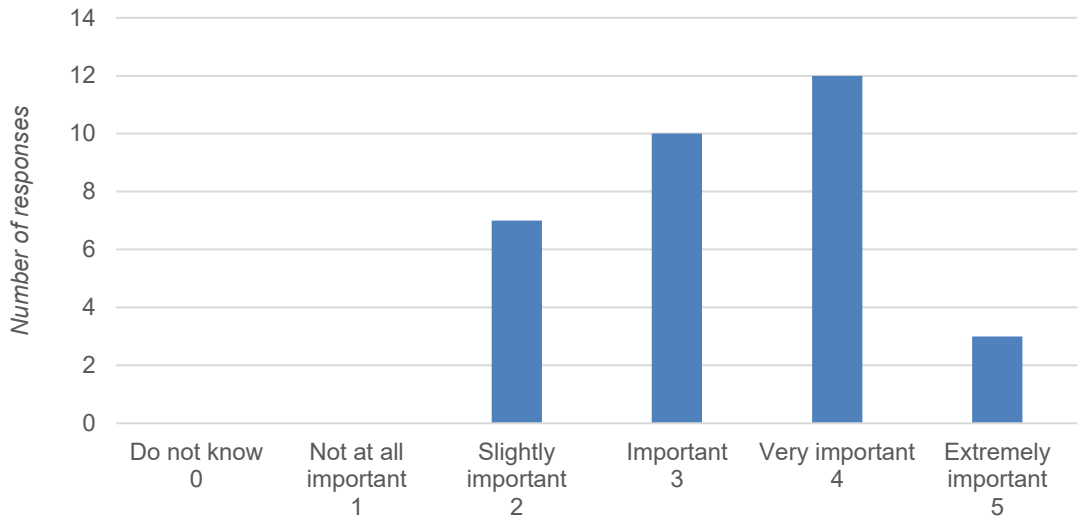

Table representing the calculated variables of the responses.

Variable	**Value**
Mode	4
Median	3
Standard deviation	0,94

Table representing the number of responses per scale item and their proportion of all responses.

Variable	**Number of responses**	**Proportion**
Do not know	0	0,00 %
Not at all important	0	0,00 %
Slightly important	7	21,875 %
Important	10	31,25 %
Very important	12	37,50 %
Extremely important	3	9,375 %

State of relationship between users and developers

Distribution of respondents' choices based on their assessment on a given scale.

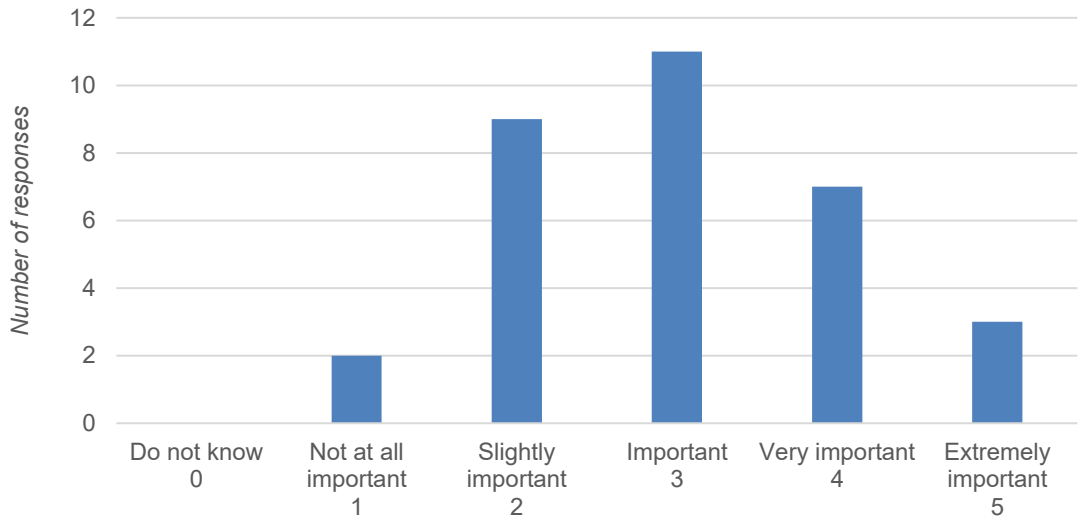

Table representing the calculated variables of the responses.

Variable	Value
Mode	3
Median	3
Standard deviation	1,08

Table representing the number of responses per scale item and their proportion of all responses.

Variable	Number of responses	Proportion
Do not know	0	0,00 %
Not at all important	2	6,25 %
Slightly important	9	28,125 %
Important	11	34,375 %
Very important	7	21,875 %
Extremely important	3	9,375 %

Management support for cloud adoption

Distribution of respondents' choices based on their assessment on a given scale.

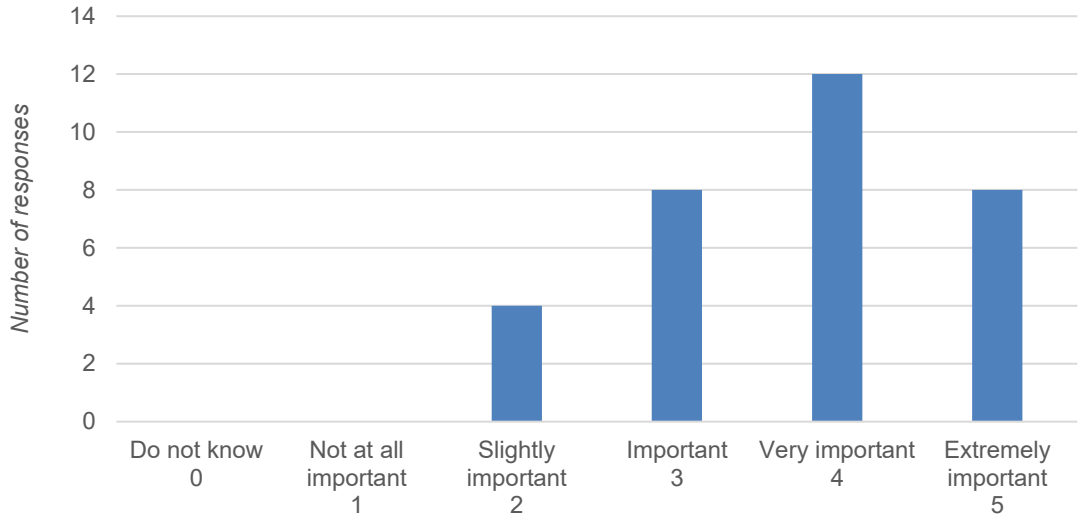

Table representing the calculated variables of the responses.

Variable	Value
Mode	4
Median	4
Standard deviation	0,98

Table representing the number of responses per scale item and their proportion of all responses.

Variable	Number of responses	Proportion
Do not know	0	0,00 %
Not at all important	0	0,00 %
Slightly important	4	12,50 %
Important	8	25,00 %
Very important	12	37,50 %
Extremely important	8	25,00 %

User involvement in cloud service implementation project

Distribution of respondents' choices based on their assessment on a given scale.

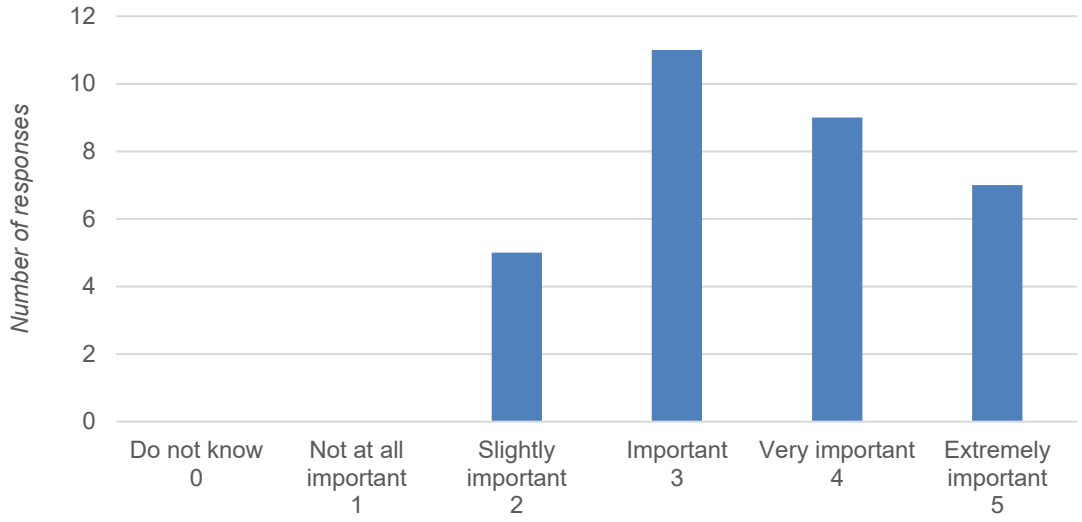

Table representing the calculated variables of the responses.

Variable	Value
Mode	3
Median	3,50
Standard deviation	1,01

Table representing the number of responses per scale item and their proportion of all responses.

Variable	**Number of responses**	**Proportion**
Do not know	0	0,00 %
Not at all important	0	0,00 %
Slightly important	5	15,625 %
Important	11	34,375 %
Very important	9	28,125 %
Extremely important	7	21,875 %

Actions to motivate employees to use cloud services

Distribution of respondents' choices based on their assessment on a given scale.

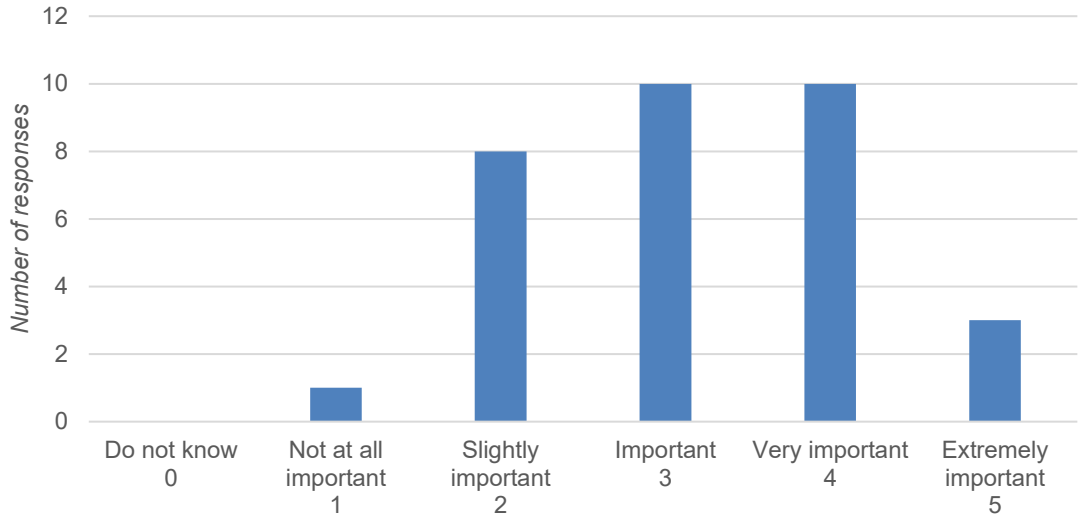

Table representing the calculated variables of the responses.

Variable	**Value**
Mode	3
Median	3
Standard deviation	1,03

Table representing the number of responses per scale item and their proportion of all responses.

Variable	**Number of responses**	**Proportion**
Do not know	0	0,00 %
Not at all important	1	3,125 %
Slightly important	8	25,00 %
Important	10	31,25 %
Very important	10	31,25 %
Extremely important	3	9,375 %

Organization's culture and policies

Distribution of respondents' choices based on their assessment on a given scale.

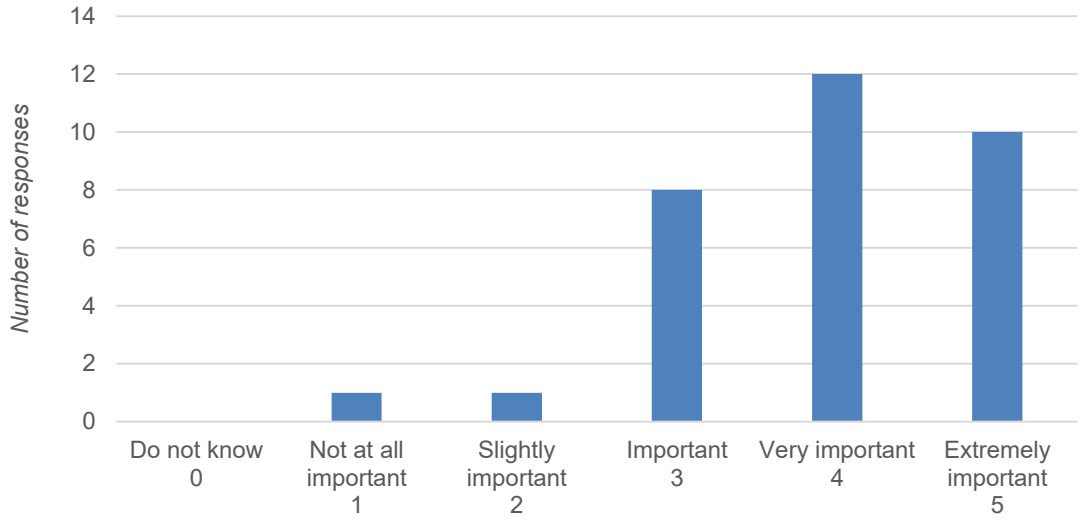

Table representing the calculated variables of the responses.

Variable	**Value**
Mode	4
Median	4
Standard deviation	1,00

Table representing the number of responses per scale item and their proportion of all responses.

Variable	**Number of responses**	**Proportion**
Do not know	0	0,00 %
Not at all important	1	3,125 %
Slightly important	1	3,125 %
Important	8	25,00 %
Very important	12	37,50 %
Extremely important	10	31,25 %

Organization's knowledge and competence on cloud services

Distribution of respondents' choices based on their assessment on a given scale.

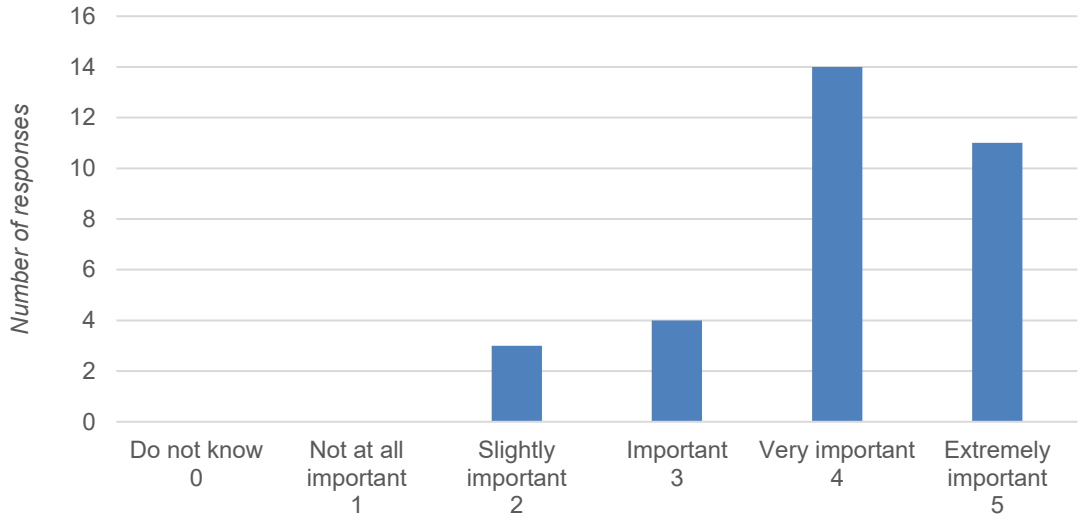

Table representing the calculated variables of the responses.

Variable	**Value**
Mode	4
Median	4
Standard deviation	0,93

Table representing the number of responses per scale item and their proportion of all responses.

Variable	**Number of responses**	**Proportion**
Do not know	0	0,00 %
Not at all important	0	0,00 %
Slightly important	3	9,375 %
Important	4	12,50 %
Very important	14	43,75 %
Extremely important	11	34,375 %